THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 50 Thursday, June 28, 1934 No. 932

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF

The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

Institute of British Foundrymen

PRESIDENT: 1933-34.
Roy Stubbs, 36, Broadway, Cheadle, Cheshire.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.
Birmingham, Coventry and West Midlands: L. W. Bolton, 21-23, St. Paul's Square, Birmingham.
Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.
London: H. W. Lockwood, Stewarts and Lloyds, Limited, Winchester House, Old Broad Street, London, E.C.2.
Newcastle-upon-Tyne: J. W. Eckford, 4, Mosley Street, Newcastle-upon-Tyne.
East Midlands: H. Bunting, 82, Otter Street, Derby.
West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.
Wales and Monmouth: J. J. McClelland, 122, Wellington Road, Bilston, Staffs.
Middlesbrough: F. A. Harper, Station Chambers, Middlesbrough.
Preston: P. Leyland, 6, Ashley Terrace, Farington, Lancs.
Lincoln: E. R. Walter, "Cavalla," Erntwell Road, Lincoln.
Burnley: J. Pell, 17, Mersey Street, Rose Grove, Burnley, Lancs.
Falkirk: H. McNair, 14, Seabegs Crescent, Bonnybridge, Scotland.

National Ironfounding Employers' Federation

President: J. Smith, Smith & Company (South Shields), Limited, Mile Street, South Shields.
Secretary: Harold G. Judd, C.B.E., 8, Frederick's Place, E.C.2.

The Institute of Vitreous Enamellers

President: Dr. J. W. Mellor, F.R.S., Stoke Technical College, Stoke-on-Trent.
Chairman: W. H. Whittle, Protector Lamp & Lighting Company, Limited, Eccles, near Manchester.
Hon. Secretary: Miss E. Christine Elliot, Davis Street, Cubitt Town, E.14.

Foundry Trades' Equipment and Supplies Association

President: R. H. Brackenbury, 13, Victoria Street, London, S.W.1.
Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association

President: W. E. Clement, Morfa Foundry, New Dock, Llanelly.
Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION

The Registered Office and Laboratories of the B.C.I.R.A. at:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM
Telephone: Central 1885. *Telegrams: CIRA*
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Mcek's Road, Falkirk (*Telephone* 332)

Contents

	PAGE
Corrosion	405
Sheltered and Unsheltered Wage Rates	405
Correspondence	406
The Tin Position	406
Random Shots	406
A Report of the Work of the Cast Iron Sub-Committee of the Technical Committee	407
Recent Developments in British Synthetic Moulding Sand Practice	410
Non-Ferrous Foundry Practice	414
This Week's News in Brief	416
Trade Talk	416
Personal	416
Company Reports	416
New Companies	416
Contract Open	416
Obituary	416
Raw Material Markets	418
Iron and Steel as the Basis of Industry	418

Corrosion

The 14th Report of the Institution of Civil Engineers, recently published by the Department of Scientific and Industrial Research, deals with the deterioration of structures in sea water, and contains the final results on the second series of tests on ferrous materials after ten years' exposure to three exposure conditions: (1) well above high-water level, (2) at half-tide level and (3) well below low-water level. These tests, which were carried out at test stations situated at Auckland, Colombo, Halifax and Plymouth, were made on wrought iron, ingot iron, cast iron, mild and medium-carbon steels, and various alloy steels. A 36 per cent. nickel steel showed a high degree of resistance under all three conditions, and was followed by a 13 per cent. chromium steel, a 3.75 per cent. nickel steel and two copper-content steels. Cast iron behaved in rather a peculiar fashion. In general, the losses in weight recorded were small, but cast-iron bars showed a serious diminution in strength, due to internal corrosion. This was observed in several instances.

The 2nd Report of the Corrosion Committee of the Iron and Steel Institute and the National Federation of Iron and Steel Manufacturers has also just been issued, and, although it does not deal with cast iron, nevertheless, contains a large amount of valuable information to all manufacturers and users of iron and steel, and, consequently, to foundrymen. The Report, which is divided into a number of sections, deals principally with the description and progress of the Committee's field tests on atmospheric corrosion, which are being carried out at various centres throughout the world; the subject of marine corrosion; and the various laboratory tests on corrosion, which are in progress. The programme of work which the Report describes, and the work which the Committee hope to put in hand, constitutes a very full investigation into the corrosion of iron and steel, and although it must of necessity take a fairly lengthy period to complete, will no doubt produce results of a very practical nature.

In addition to the work being done on these ferrous materials, investigations are also in progress dealing with non-ferrous alloys. Some of these are being undertaken by the British Non-Ferrous Metals Research Association, and others by private enterprise and various Associations. The result of these activities has been that during recent years several new corrosion-resisting alloys have been evolved. Among those alloys and of special interest to foundrymen are the cast irons known under the names of Nimol, Ni-resist and Nitricast iron. It is also of interest to note that investigations on copper-bearing cast irons have shown that such irons have superior corrosion-resisting properties over ordinary cast iron under certain conditions, so that a wider application for such irons may be possible in the near future.

Sheltered and Unsheltered Wage Rates

We have several times pointed out the disparity between wage-rate increases in the sheltered and unsheltered occupations, and a sufficient period has now elapsed since fluctuations in these rates to show how they are likely to be stabilised. Some figures based on official returns have recently been issued, and are very instructive. They also emphasise the much larger extent of the increase for labourers as compared with skilled workers.

Engineering labourers received in July, 1914, the sum of 22s. 10d. per week, averaging the recognised rates in 16 leading centres, while in December, 1932, the rate was 42s. 1d. Averaging 28 large towns, labourers employed by local authorities were paid 26s. 9d. in July, 1914, and 50s. 8d. in December, 1932. For the same periods, the wages, averaged from recognised rates in 16 large towns, of fitters and turners were 38s. 11d. and 59s. 1d. respectively; for patternmakers, 42s. 1d. and 63s. 4d.; and for moulders, 41s. 8d. and 62s. 4d. respectively. Thus, the rate for labourers has increased more than that for skilled men.

Cabinet makers, upholsterers and french polishers, who are mainly employed for the home market, earned in 1914 rather less than engineering fitters and patternmakers, but now earn several shillings a week more, as do all skilled men in the building trades.

Tramway drivers, averaging the wage of 46 towns, earned 31s. a week in 1914 and 58s. 5d. in 1932. We wonder what reflections arise in the mind for a skilled fitter, who has probably served a lengthy apprenticeship and suffered much unemployment, when he rides home at night behind a driver who earns to within a few pence per week the same wage? Naturally, the industries who live by competing in a foreign market, as does much of our engineering industry, cannot afford to pay so much as those which can draw on the rates. Bearing in mind the cost of living, the real wages earned by the engineering craftsman, fitter, patternmaker or moulder, is about 5 per cent. or 6 per cent. above the pre-war level. The real wages of labourers are 29 per cent. and 32 per cent. above, for unsheltered and sheltered industries respectively, and of tram drivers 31 per cent., and of conductors 40 per cent.

XUM

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

X-Ray Testing

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I was very pleased to see your leading article on "Testing by X-Rays" in your issue of June 21, and am very glad that you have brought this subject to the notice of your readers, who, I presume, are in the main engaged in the foundry trade. When I was awarded the Research Medal of the Staffordshire Iron and Steel Institute for my thesis on "X-Ray Analysis of Iron and Steel," I was accused of being too optimistic of the future of this method of analysing and testing, but I am still of the opinion that analysis by means of X-rays will become at some date in the future one of the mainstays not only of the research laboratory but of the general works laboratory, and I am glad to know that some of the larger works are already installing apparatus to carry out analyses by this means.

It always seems to me, to use a somewhat peculiar simile, that X-ray analysis can easily become the "finger-print" department of any steel or iron works. Take, for example, a pure pearlitic steel of 0.89 per cent. carbon. An X-ray photograph of any one sample of this steel must of necessity be exactly the same as any other photograph of a similar specimen under the same conditions, consequently when we have the full history of a piece of metal and its X-ray photograph we have only to take the photograph of any other piece of metal, and if the latter is identical with that photograph we know everything about the specimen we wish to examine without any further analysis, testing, etc. This is obvious, because we are dealing with the fundamental structure of the steel—that is, the crystal lattice itself.

Certainly until quite recently, when either very thin flakes or powder were the mediums by which one could only examine a metal by means of X-rays, there did not appear to be a great deal of scope for those outside the research-laboratory department, but now that the X-ray apparatus can be taken up to any object, such as a girder, for example, it would appear that a great many of the difficulties have been largely overcome. In the past it is fairly obvious that it would have been impractical to use X-ray analysis for ordinary foundry practice, but now that a large specimen can be examined without in any way damaging it, it seems very probable that it is likely to extend to the foundry industry as well as to the steel and non-ferrous industries, and I hope that in the near future your readers will have a chance of learning more of this very fascinating, and what I am confident will become a very useful, adjunct to the industry as a whole.—Yours, etc.,

C. HUBERT PLANT,
Secretary, The Midland Metallurgical Societies.

"Bryn,"
Park Hall Road, Walsall,
June 26, 1934.

Research on Metals

The 14th annual report of the British Non-Ferrous Metals Research Association was presented recently to the general meeting of the Association. The number of researches in progress during the year was 15, and the expenditure was nearly £22,000. Reviewing the research work carried out, the Report states that considerable progress has been made with the study of the effect of impurities on the mechanical and rolling properties of various non-ferrous metals and the influence of varying amounts of different impurities on the quality of the finished product.

The Tin Position

BY "ONLOOKER."

Developments in the tin situation continue to go all one way, *viz.*, along the lines laid down by the International Tin Committee, irrespective of how the action taken may affect the consumers of the metal. The latest achievement by those in charge of the fortunes of this metal is in securing the assent of the signatory governments to the formation of the buffer pool, a measure threatened for some time past and now finally agreed to take effect from June 1 last. The official statement issued by the International Tin Committee reports that sanction has been given for the accumulation of 8,282 tons of tin by December 31, this being achieved by means of a special quota of 5 per cent. of the standard tonnages.

The formation of the buffer pool comes at a time when the future of tin is not looking too bright, for the tendency of the London market is definitely downwards, and at the time of writing the price is within measurable distance of £220, the rate of the decline having been equal to £1 per day. Total visible supplies are under 18,000 tons, and stocks in this country are very low, but they have recently been bolstered up to some extent by the arrival at Liverpool of Dutch tin, this fact probably accounting for the narrowing of the backwardation to 10s. after standing at one time at more than £4. Buying of tin is not at all brisk, for things are very quiet in the tinplate trade, although stocks of canned goods in the States are said to be low, while in the motor-car industry there is a slowing-down in the demand for new cars, which cannot fail to have an effect upon tin.

During 1933 the world's tin consumption was in the neighbourhood of 132,000 long tons, but this, although better than 1932 by fully 25 per cent., makes a poor showing beside the average for 1928-29, which was 177,500 tons. So far this year the rate of usage has not been very encouraging, and it is rather doubtful whether 1934 will show any improvement over 1933, for the tinplate mills in the U.S.A., and in South Wales, which in the early part of the year were doing well, are now not running at much over 50 per cent. of capacity. Reference has been made to the canning trade, and it may be taken as certain that, in spite of the greatly increased popularity of canned goods, the present price of tin is acting as a check to developments in that direction. Inevitably the high level of the quotation is encouraging the search for substitutes, as well as speeding up output at those properties which are not parties to the agreement.

All things considered, it looks very much as if tin were destined for a further fall, unless, of course, the situation in the United States should change so drastically as to bring about a fresh wave of buying sustained in character. Of this there is not at the moment any indication, for the labour situation in America is far from good, the prospects for steel being gloomy by virtue of strike threats. What goes on in the States is, of course, of paramount importance to the tin industry, for America is still easily the world's biggest consumer of the metal. There has been talk of payments to the United States in kind, and in such an event doubtless tin would be one of the commodities shipped, but of this plan there is absolutely no confirmation.

Although in all the manœuvres connected with tin the consumer has received but scant attention, he still figures in the picture, and, having made up his mind that tin is over-valued at any figure above £200, it is useless to look for much buying around the present level. Buffer pool or not, tin looks like going lower.

Random Shots

The responsibility of shooting at random is indeed great. Some of the random shots sail harmlessly skywards, and in arriving ultimately at their haphazard destination excite little comment and cause no perturbation. The firing of other random shots, it seems, is attended by some danger to "Marksman," in addition to the devastating results when and where the shot strikes its target.

* * *

To be taken to task is, of course, no unusual experience for "Marksman." All who play with firearms run that risk, but to be deliberately chastised, in the same week, by both "One Cook" and Miss Snookers is indeed to feel the weight of great tribulation. "Marksman" must confess to his readers that, like the swain who recovered consciousness on the lawn of his fair one's home, with her irate parents' description of his ancestry still ringing in his ears,

"There was a howling wind and a blinding rain
And the world never seemed quite the same again."

The slings and arrows of "One Cook" leave no permanent marks on "Marksman's" hide. They can be treated with the scorn they richly deserve. Needless to refute is the outrageous libel that "Marksman" was consorting with Miss Snookers at 1 a.m. It is quite evident that "One Cook" does not *know* Miss Snookers as "Marksman" does. (Miss Snookers' own refutation cannot be used in evidence here for reasons which become clearer later.)

* * *

"Marksman" is convinced that "One Cook" (or should it really be "Wun Cook"?) wrote his scurrilous letter only to prove he could write the Yorkshire dialect, and whilst "Marksman" deplores his hasty rush for print, and his attempt to gloss over the real real issue by reference to half tones and jealous singers, yet he is compelled to admit that "Wun Cook's" evident knowledge of, and respect for, the great anthem of Yorkshire shows a taste for the beautiful and glorious, somewhat surprising in a Chinaman.

* * *

With Miss Snookers' communication the issue is entirely different. "Marksman" candidly confesses himself in the throes of a turbulent problem, on the horns of a damnable dilemma. The issue is largely one of delicate diplomacy or diplomatic delicacy, or both. If, readers, you have ever dropped an ice down a lady's frock, presented a third-class ticket to an Inspector in a first-class carriage, or suddenly become aware of a temporary suspension of the normal activities of your trouser supports whilst speaking at a dinner, you can sympathise with the plight in which "Marksman" finds himself. "Marksman" is between the devil of truth and the sea of chivalry.

* * *

In her letter, Miss Snookers definitely states that she was not in Manchester at the time and place mentioned. For reasons best known to herself, Miss Snookers has chosen to avail herself of "Marksman's" well-known chivalrous regard for her to enable her to extricate herself from an embarrassing situation. Well, if Miss Snookers feels that by calling upon "Marksman" to subscribe to her deception, he is well content to serve, and the less said the soonest mended. Nevertheless, Miss Snookers was in Manchester at the Conference. When "Marksman" called in the Gayway foundry last week on a matter of business she was wearing a long white smock, girdled at the waist, and picked out with red buttons round the neck and sleeves, and with graceful folds of georgette at the yoke—quite *chic*, of course, and, in a moment of indiscretion, she said she got the idea from the overall worn by a very high official of the Institute whom she had seen in his foundry during the Conference.

"MARKSMAN."

A Report of the Work of the Cast Iron Sub-Committee of the Technical Committee*

The Cast Iron Sub-Committee of the Technical Committee is the only sub-committee that has had any comparative predecessor in the Institute, for it followed the Test-Bar Committee, which had so ably drawn up the B.S.I. Specification 321/28 for grey-iron castings involving the use of round test-bars, varying in diameter with the section of the casting represented, and had also investigated and reported upon the Frémont Test.

On the formation of the Technical Committee, the first natural action was to take up the question of specifications and tests. During its first year of activity this sub-committee devoted its attention mainly to the collection and co-relation of existing specifications. The collection of specifications proved a difficult matter, but from those that were collected it was evident that the adoption of the then comparatively new B.S.I. 321/28 specification was far from general. Several specifying authorities were persuaded either to change their specification to conform with the B.S.I. 321/28 or to sanction this as an alternative to their own specification. Since then the question of specifications has not received much attention from the sub-committee, but this subject will be reverted to at the end of this Report.

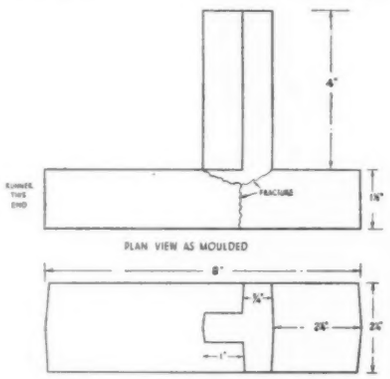


FIG. 1.—TEST FOR POROSITY

During its early days the sub-committee drew up a list of the published physical properties of cast iron, including specific gravity, specific heat, thermal conductivity, coefficient of expansion and electrical conductivity. In June, 1932, this report was made available to members.†

On completion of the first year's work the sub-committee was enlarged and proceeded to ask itself in what directions it might prove of most value to the grey-iron industry. It was decided to pursue investigations on the following four subjects:—

(1) To investigate the theory that had been expressed in various quarters that the properties of cast iron in relation to strength and soundness were at their worst when the phosphorus content was approximately 0.4 to 0.6 per cent., or, in other words, a "dangerous range" existed at this composition.

This subject opened up the very general one of porosity and strength of cast iron in relation to its constituents, and this has occupied most of the attention of the sub-committee, thus forming the major part of the report.

(2) To compile a series of photomicrographs representative of various grades of cast iron which might be used as a reference standard by metallurgists throughout the Industry.

The first part of this work has been completed in collaboration with the British Cast Iron Research Association, and the "Typical Microstructures of Cast Iron, Series I," was issued to members of the Institute in December, 1933.† Prior to the publication of this booklet, a great deal of discussion took place in the Technical Committee as to the desirability, or otherwise, of issuing details of the analyses and physical properties of the specimens illustrated. The committee decided that it would be very misleading to state any particular composition or strength for any one structure, as the structure is also dependent upon the history of the sample with reference to original materials, melting methods, section of casting, etc.

(3) To attempt to evolve rules for the contraction of cast iron according to composition, section and pouring temperature.

It was found that there was great difficulty in accurately measuring slight differences in contraction and, with the exception of work on long bars referred to in the body of this report, this subject could not be carried any further at present.

(4) To examine existing methods of wear testing with a view to recommending a standard form of test.

The sub-committee have given constant thought to this problem, the principal obstacle to its solution being the lack of an exact definition of wear, which word covers a multitude of phenomena differing in essential details.

A preliminary examination of existing methods revealed that so many factors were involved, and that conditions of wear were so varied, that a standard test was not desirable or practicable at the present time. The data collected for this examination were published in the form of a Paper.[1]

The sub-committee feels that the difficulty of imitating practical conditions in laboratory tests, and the length of time necessary to obtain results, make the problem of wear testing more difficult than a first consideration would seem to indicate. It has been suggested that a detailed consideration of the stress conditions between wearing faces will be necessary before much progress can be made in explaining the varying results which are obtained, and that attention will have to be paid to the definition of wear.

(5) Recently an investigation has been started on the subject of carbon pick-up in the cupola. This is still in its preliminary stages, but sufficient data has already been produced to open up a very useful line of work. Details of the experiments so far carried out are given in this report.

Porosity and Strength of Cast Iron—Preliminary Work

A preliminary examination of the question as to the existence of a "dangerous range" of phosphorus failed to reveal any published expression of opinion on the subject. The works of Wüst,[2] Mackenzie[3] and Hamasumi[4] all reveal that the strength of cast iron is maintained up to 0.3 per cent. P, after which there is a gradual falling-off of strength. Bolton,[5] in his summary of the effect of phosphorus on cast iron, does not give any indication of a dangerous range. Molineux,[6] when discussing cast iron for cylinders, stated that he has had satisfactory results in cylinders with chilled bores with irons of the following composition:—T.C., about 3.2; Si, 1.4 to 2.0; Mn, 0.5; S, 0.1 max.; and P, 0.4 to 0.5 per cent. In the discussion on this Paper it was agreed that P 0.4 to 0.5 per cent. had been successfully used, but that the normal Continental practice was to use 1.2 per cent. P and American practice to use 0.2 per cent. P. This latter statement is confirmed by Bolton.[5]

F. J. Cook, however, asked by the sub-committee for his views, gave some examples of faulty castings that had been cured by raising the phosphorus from 0.5 per cent. up to 0.7 or 1.0 per cent., or by reducing it to 0.3 per cent. These troubles were principally concerned with hair cracks, and he was unable to state whether the carbon had been automatically varied with the phosphorus or not. He also stated that in some crucible-melted tests on straight blast-furnace iron, a drop in the properties occurred at 0.5 per cent. P, quite out of line with the rest of the series, though this phenomenon did not show when the tests were repeated with a refined pig-iron.

It was decided that experimental work should be carried out to determine the relationship between composition and strength and porosity. In this connection it must be stated that the porosity investigated was that which occurs as irregular internal voids in a casting, of the type illustrated in Fig. 6, and must not be confused with other phenomena which are sometimes loosely classified as either drawing or porosity, viz., gas holes (as illustrated in Fig. 2, top specimen), external shrinkage or piping (as illustrated in Fig. 3), gas generated from entrained slag, or general openness of grain due to the presence of very coarse graphite throughout the casting.

The first necessity in carrying out these tests was to find a satisfactory porosity test. The first experiment was with a double cylinder, cast solid and bored so as to leave a standard thickness of metal between the bores at a spot where porosity was most likely to occur,[7] as it did. It was hoped that a quantitative measure of porosity might be obtained by observing the rate of leakage from one bore to another. From this point of view it proved to be a failure, as all the samples tried either gave no leak at 500 lbs. per sq. in. pressure or leaked so rapidly at low pressures that it was impossible to obtain comparative measurements.

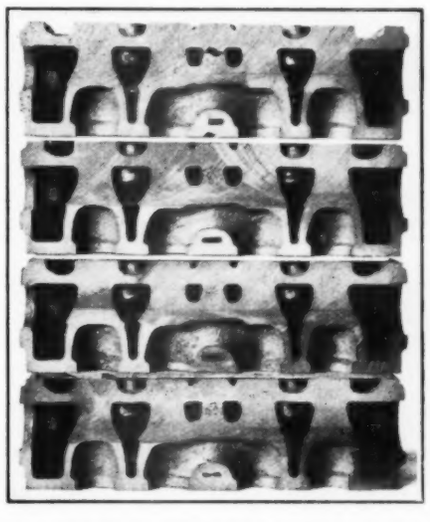


FIG. 2.—INFLUENCE OF POURING TEMPERATURE ON THE POROSITY OF CYLINDER HEADS. T.C. 3.2; Si 2.0; Mn 0.46; S 0.08 and P 0.40 per cent. The temperatures given were read on an optical pyrometer and no correction factor has been applied.

It was reported to the sub-committee that attempts to measure porosity by measuring the rate of flow of gas through a disc of metal failed in a similar way, the discs being completely gas-tight if observable porosity was absent, although with exceptionally thin sections leakage of gas via the graphite flakes was obtainable.[8] This latter, however, was not within the scope of the

* A Report presented at the Annual Conference of the Institute of British Foundrymen, held at Manchester, June 5 to June 8.
† Available to Members on application to the General Secretary.

present investigation. Efforts to explore porosity by specific-gravity tests on grey cast iron also proved fruitless.

The familiar K test-piece[5] was found to be insufficient as most samples failed to show any porosity on fracture, and an enlarged form of this was used in the shape of a T casting. This was adopted as the standard porosity test throughout the experiments detailed below, though it has the disadvantage that the porosity can only be measured by comparative observation and cannot be quantitatively determined. The dimensions of this test-piece are given in Fig. 1. A further porosity test was evolved by

FIG. 3.—EFFECT OF POURING TEMPERATURE ON SHRINKAGE. The samples have been cast at decreasing temperatures and (above) is a sectional casting of No. 4.

sectioning actual castings of cylinder heads, and, for clarity of results, this method has proved to be the most satisfactory of all, and, where available, these are illustrated in preference to the T-tests.

The investigations of the sub-committee have followed two definite lines, one set of experiments being made on irons where all the elements were fixed, with the exception of the one under investigation, whilst other series were investigated in which the total carbon was increased as the phosphorus was decreased, which is the normal effect when mixing hematite irons and phosphoric irons in different proportions. The conclusions to be drawn from the former method are naturally more easy to follow.

Attention was drawn to the risk of conflicting results being obtained on account of varying casting temperatures and mould conditions. Throughout the experiments these were kept as constant as possible in any one series, the casting temperatures in Series I to VII being controlled at a constant figure by an optical pyrometer read by the same operator throughout.

To ascertain the seriousness of the risk of the experiments being vitiated by varying casting temperature, a set of four cylinder heads were cast from the same ladle of metal at decreasing temperature. These are shown sectioned in Fig. 2. The specimen cast at the lowest temperature (so low that the casting would hardly run) shows a bubble of entrained gas, but otherwise the difference between the observable porosity is insufficient to upset the data obtained from this test.

Tests made on the usual cone test-piece showed that the pouring temperature affected the external sinking of the metal, but not the internal porosity, and T-tests confirmed this. These results are shown in Figs. 3 and 4. The cones, when sectioned, showed no signs of internal porosity. Incidentally, this set of experiments shows that the cone test is unsatisfactory for routine foundry control, as the volume of sink varies more with the pouring temperature (which is so difficult to control exactly) than with the changes in composition of the metal.

A close examination of Hailstone's work[6] on the influence of pouring temperature revealed that there was little evidence of low pouring temperatures giving increased porosity as it is defined in this Report, but that the incidence of gas-holes became very pronounced. All porosity tests, whether T-bars or cylinder-head castings, in these series of experiments were made without feeder heads so that no complication occurs in that respect.

Experimental Work

At the initiation of these investigations the sub-committee found that one of its members was engaged on a research into the effect of phosphorus in cast iron, now completed and published.[7] The sub-committee were in touch with the progress of this research and particular attention was paid to such parts of it as might throw light on the problem in hand. Parts of this research are referred to in this report as:—

Series I, the general composition of which was T.C. 3.3, Si 2.1, Cr 0.3 and phosphorus varying from 0.07 to 1.1 per cent.

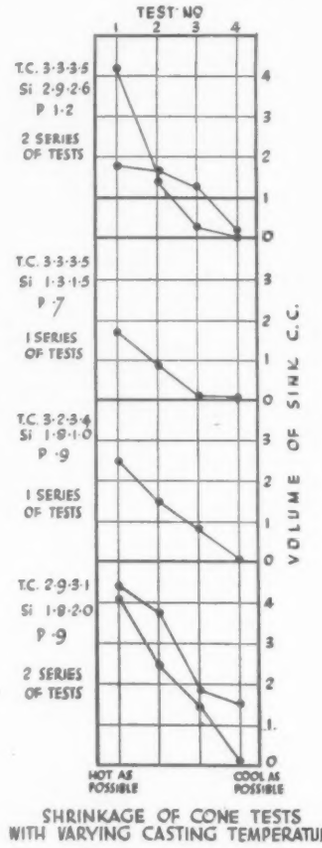


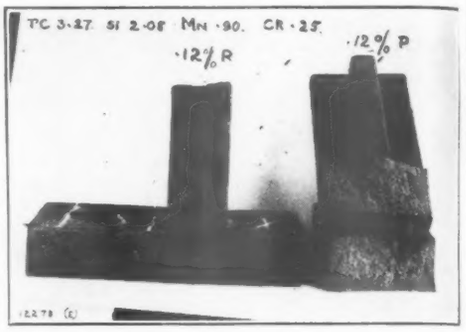
FIG. 4.—EFFECT OF POURING TEMPERATURE ON SHRINKAGE. GRAPHS OF SHRINKAGE OF CONE TESTS WITH FOUR DIFFERENT TYPES OF IRON.

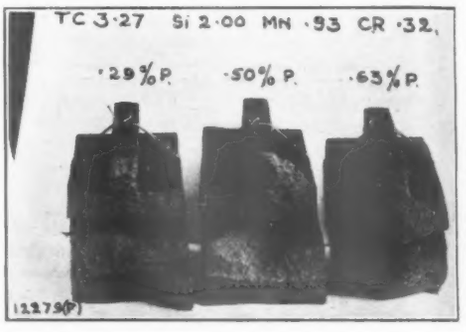
On completion of this work the same member undertook the preparation and examination of a further six series (this time without the presence of chromium) as follows:—

Series II.—T.C. 3.6, Si 2.0, phosphorus varying from 0.25 to 1.0 per cent.

Series III.—T.C. 2.6, Si 1.9, phosphorus varying from 0.18 to 0.75 per cent.

Series IV.—T.C. 2.6, P 0.8, silicon varying from 2.0 to 3.2 per cent.





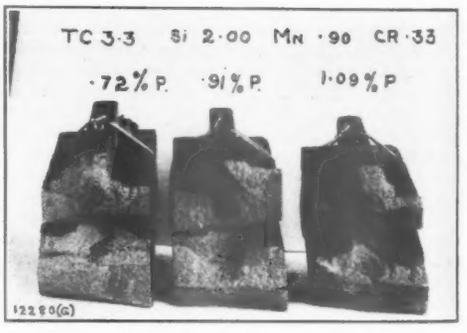


FIG. 5.—SERIES I. T-TESTS SHOWING THE INFLUENCE OF PHOSPHORUS ON FRACTURE.

Series V.—T.C. 2.6, P 0.06, silicon varying from 2.0 to 3.2 per cent.

Series VI.—Si 1.9, P 0.86, total carbon varying from 2.8 to 4.0 per cent.

Series VII.—Si 1.9, P 0.16, total carbon varying from 2.8 to 4.0 per cent.

On each of these series porosity tests in the form of cylinder heads and T-bars were taken, also transverse and tensile tests on "S," "M" and "L" bars. The metals for Series I, II and III were cupola-melted in a small experimental cupola, ferro-phosphorus being added to a suitable base iron. Series IV, V, VI and VII were crucible-melted, IV and V by the addition of ferro-silicon to a suitable base iron, VI and VII by mixture of a low- and a high-carbon hematite, the same quality low-carbon hematite being used throughout. The analysis of each cast was taken and came very closely within the common standard, and need not be given *in extenso*.

Some of the results on Series II and III were given in a Paper[10] to the French Foundry Con-

ference in November, 1933, but the results on the other series have not hitherto been published.

At the same time, another member was carrying out a research into "The Influence of Phosphorus on the Properties of Hardened and Tempered Cast Iron." This work has also been completed and published.[11] Again the sub-committee were in touch with the author during the progress of his experiments, and such of the data obtained that is included in this report is classed as

Series VIII, having Si 2.4, Cr 0.6, with phosphorus increasing from 0.04 to 1.6 and total carbon decreasing from 3.8 to 3.4 per cent. Other members of the Sub-committee made further series as follows:—

Series IX.—T.C. 3.0, Si 1.2, Ni 2.0, phosphorus varying from 0.17 to 1.0 per cent.

Series X.—Si 2.35, total carbon decreasing from 3.7 to 3.2 per cent., while phosphorus increased from 0.06 to 1.13 per cent. All these series were crucible-melted, Series VIII being made by the melting of hematite and phosphoric irons in separate crucibles and mixing the metal in varying proportions. Series IX was made by the addition of ferro-phosphorus to a suitable base iron, and Series X by melting together suitable amounts of hematite and phosphoric irons of known composition, each set of tests being poured from a separate pot.

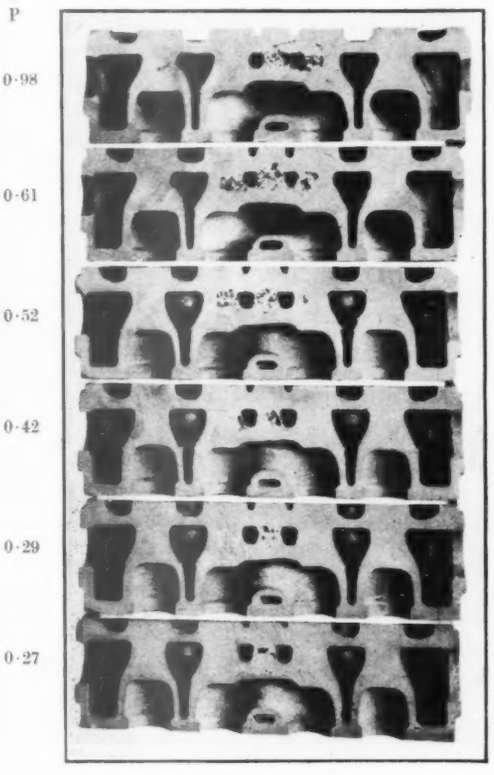


FIG. 6.—SERIES II. SECTIONED CYLINDER HEADS. T.C. 3.6; Si 2.0; Mn 1.9 and S 0.045 with increasing Phosphorus.

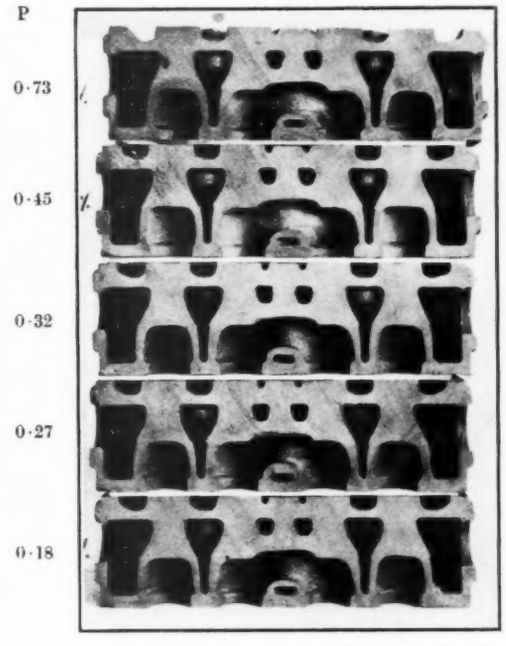


FIG. 7.—SERIES III. SECTIONED CYLINDER HEADS. T.C. 2.6; Si 1.9; Mn 0.9; S 0.04 with increasing Phosphorus.

Porosity Tests

The results of porosity tests on the above series were as follow:—

Series I.—These tests showed soundness up to 0.3 per cent. P and a gradual increase in porosity beyond (Fig. 5).

Series II.—The T-tests showed soundness up to 0.3 per cent. P and a gradual increase of porosity beyond.

The sectioned cylinder heads all showed slight porosity, increasing with rise in phosphorus, though there seemed to be a definite step in the increase as the phosphorus was increased from 0.42 to 0.52 per cent. (Fig. 6).

Series III.—The T-tests showed soundness up to 0.73 per cent. P. Slight porosity appeared after this, increasing with phosphorus.

The sectioned cylinder heads were all sound (Fig. 7).

Series IV.—The T-tests showed slight porosity with 2.40 per cent. Si and above, whilst the cylinder-heads had very slight porosity with 2.4, 2.62, and 2.88 per cent. Si, whilst the others were all sound (Fig. 8).

Series V.—Both the T-tests and the cylinder heads were all sound (Fig. 9).

Series VI.—The T-tests showed increasing porosity, which was very slight with 2.8 and 3.08 per cent. T.C., whilst the cylinder heads with 2.8 per cent. T.C. showed slight porosity; that with 3.08 per cent. T.C. was sound, but there was increasing porosity thereafter (Fig. 10).

Series VII.—The T-tests showed increasing porosity. The cylinder heads with 2.81 per cent. T.C. were sound, but there was increasing porosity thereafter, but much less than was exhibited by Series VI (Fig. 11).

Series VIII.—No porosity tests taken on this series.

Series IX.—In the T-tests no porosity was exhibited by any of the samples.

Series X.—In the T-tests porosity was present in samples 3, 4 and 5, but absent in samples 1, 2 and 6 (Fig. 12).

Conclusions from Porosity Tests

The evidence of all these tests is that total carbon and phosphorus are very important factors in controlling porosity, and are interrelated. If a perfectly sound casting be the only consideration, it is apparent that the best way is to employ low total carbon (about 2.6 per cent.), in which case the phosphorus and silicon may vary within fairly wide ranges without incurring porosity. Low total carbon irons are, however, notoriously difficult to handle in the foundry, their high freezing points and great liquid shrinkage giving difficulty in obtaining castings that are sound in other respects.[12] The high shrinkage of the irons employed in Series II as against Series III is illustrated in Fig. 13.

The evidence of all the tests shows that soundness can be maintained if total carbon be increased up to about 3.3 per cent., providing that the phosphorus be kept below 0.3 per cent. Irons of this type are much more easy to handle in the foundry, and thus provide a much more satisfactory way of overcoming porosity. Only slight porosity is incurred if carbon is increased up to 4 per cent. with phosphorus below 0.2 per cent. The effect of silicon from 2.0 to 3.2 per cent. on low carbon irons has been demonstrated to have little effect on porosity, particularly in combination with low phosphorus.

The sub-committee does not wish these statements to be taken as meaning that the only way to eliminate porosity is to use materials of the compositions given, for it is well aware of the fact that castings free from porosity are produced daily in other compositions. The sub-committee is, however, unable to resist the conclusion from this and other experimental work, that the composition, in so far as total carbon and phosphorus are concerned, is of the utmost importance in controlling porosity, and that a greater range of silicon and carbon variation is permissible when using low phosphorus irons than when using high phosphorus irons.[7]

It is pointed out that in the above conclusions porosity has been the sole consideration, and such factors as hardness, etc., may sometimes rule out the employment of irons of the type suggested.

With regard to the "dangerous range," so far as porosity is concerned, the advantages of phosphorus being below 0.4 per cent. are abundantly illustrated, but the only evidence of an improvement with phosphorus rising above 0.6 per cent. is in Series X, in which there is a reduction in total carbon with the increase of phosphorus, and it is almost certain that the improvement is due to the fall in carbon more than counteracting the rise of phosphorus.

Physical Tests

The physical tests were carried out as a subsidiary part of the porosity investigations, so that the experiments were not necessarily conducted on lines best calculated to produce the most informative results.

The results of the physical tests on all these series are shown graphically in Figs. 14 to 23. The transverse tests are expressed as transverse rupture stress throughout, and have in all cases been corrected for bar size. Nearly all the results plotted are the average of duplicate tests, and the points in the graphs are linked for the sake of identification. The same notation is used throughout, and all graphs are plotted to the same scale so that one set of results can be readily compared with another.

In Series VIII, the tensile strength was calculated from ring tests, and the Brinell hardness was taken with a Firth hardometer 2 mm. ball 30 kg. load, all other Brinell tests being taken on the centre of the broken test-bar using a 10 mm. ball with 3,000 kg. load.

The sub-committee cannot explain the high values obtained in the transverse tests of Series I for the "M" bars with phosphorus above 1 per cent. These particular results were confirmed by repetition, but no corresponding increase is observed in the S. & L. transverse bars or in any of the tensile bars.

(To be concluded.)

THE LONDON & NORTH EASTERN RAILWAY have placed orders for 620 tons of cast-iron permanent-way chairs with five firms.

Recent Developments in British Synthetic Moulding Sand Practice

By John J. Sheehan, A.R.C.Sc.I., A.I.C.

(*Concluded from page*

When the surface tension between bond and sand grains is higher than between bond and metal surface, moulding sand sticking to the pattern should be a rare occurrence. These conditions are diagrammatically represented in Fig. 9.

Previously, and particularly in American synthetic moulding-sand practice, increased surface tension effects between bond and grain were obtained by solution in the water of the green bond of such substances as soluble alkalies; glycerine; solution of sodium lactate; molasses; sugar solutions (corn or cane), and wood extracts, but as these additions also increase the surface tension between the metal pattern and the bond, there is danger in their addition, and the previously-mentioned method of preparing or selecting the sand grain is preferable.

This subject of the physical condition of the base sand grain in moulding sands is interesting and important, and the above experiments do not by any means exhaust the possibilities of such an investigation, either from the purely scientific view point or from the point of view of practical application in the foundry. It is possible easily to burn on ferric hydroxide or other compound on the sand; later a method of doing so will be described.

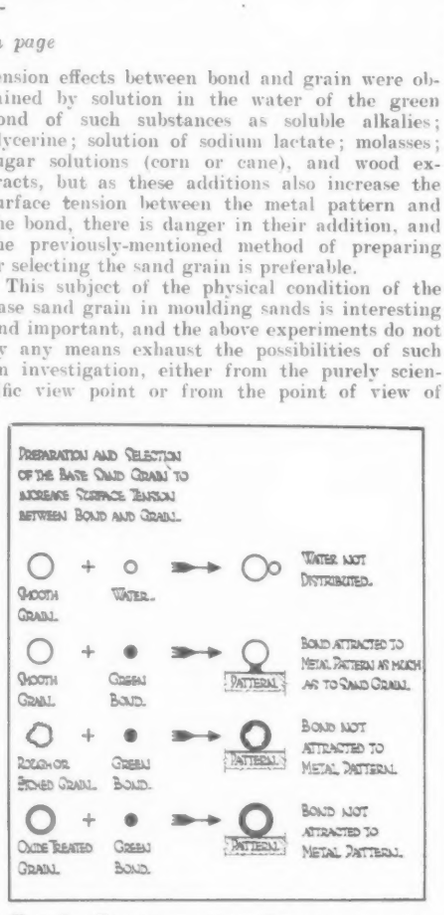


FIG. 9.—PREPARATION AND SELECTION OF THE BASE SAND GRAIN TO INCREASE SURFACE TENSION BETWEEN BOND AND GRAIN.

The experiments certainly point to a choice of a particular type of silica sand grain as the basis of synthetic moulding sand, and such choice has been incorporated with satisfaction in the synthetic moulding sand used by the author.

Solely as an experiment of laboratory interest, a red sand of the Bunter type was synthesised by using a rough-grained silica sand, on which ferric oxide was burnt on, and a clay bond. This sand had all the appearance of the sands from the Bunter deposits—colour, feel, surface tension phenomena, and the added advantages of freedom from deleterious alkalies.

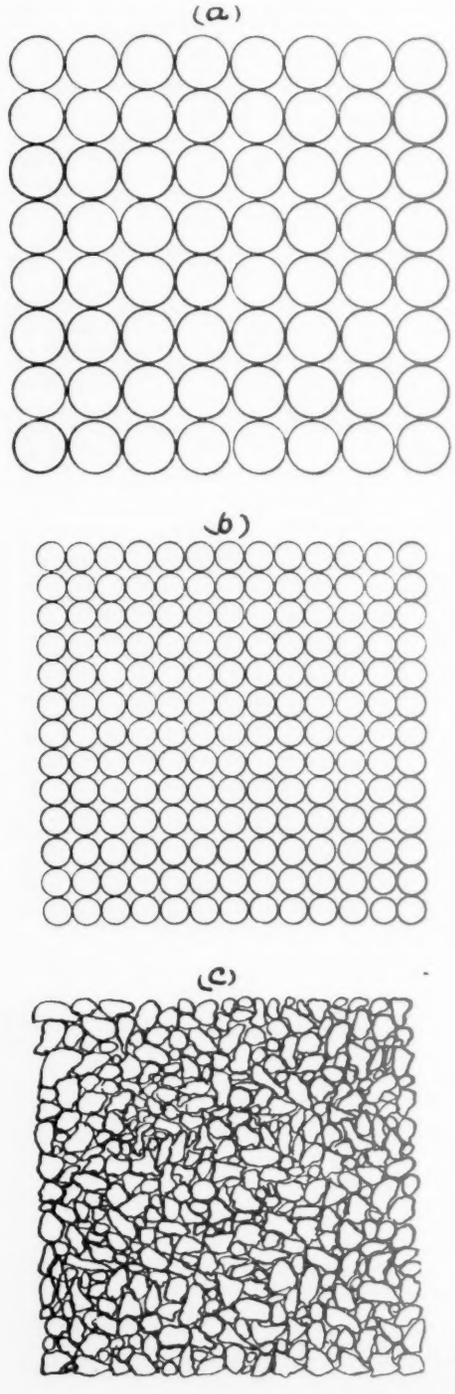


FIG. 8.

Continuing the second stage of the investigations and maintaining the semi-synthetic sand consisting of a mixture of Belgian sand and Southport sand, which still gave excellent results, a thorough examination of the Belgian sand was undertaken. It was felt that if an examination of the red sand revealed some characteristics to be avoided in a synthesis, the examination of the Belgian yellow would reveal some attributes to be desired.

While a very thorough investigation of this sand was undertaken in the Austin Laboratories, much valuable help was obtained on this sand, and indeed all through the investigation, from a "Memoir" by P. G. H. Boswell, O.B.E., D.Sc., namely, "British Resources of Refractory Sands," published in 1918, and it is proposed to quote extensively from this "Memoir."

Chemical Composition

The following are figures from the "bulk analysis" of this sand:—

Boswell.			*Austin Laboratories.*	
	Per cent.		Per cent.	Per cent.
SiO_2	86.47	SiO_2	93.3	92.75
Al_2O_3	4.96	Al_2O_3	2.23*	3.6
Fe_2O_3	2.58	Fe_2O_3	1.40	1.00*
FeO	0.29			
MgO	0.37	MgO	0.30	0.30
CaO	0.26	CaO	0.30	0.30
Na_2O	0.12	Na_2O }	0.61	0.50
K_2O	0.47	K_2O }		
H_2O+	2.44			
H_2O-	1.54	H_2O-	1.37	1.45
CO_2	None			
TiO_2	0.40	TiO_2	0.20	0.20
ZrO_2	None	—	—	—
P_2O_5	0.09	—	—	—
SO_3	None	—	—	—
Cl	Trace	—	—	—
MnO	Trace	—	—	—
BaO	Trace	—	—	—

* Variation consisted only in the substitution of some alumina by some ferric hydroxide.

The Austin analyses are of samples that show variation in bulk consignments and were undertaken to ascertain what these variations consisted of and their possible effect in the moulding system. The interpretation of these analyses reveal the reasons for its suitability as a moulding sand.

The soluble and easily fusible alkalies are present in small amounts only; the same is true of the lime, magnesia and baryta contents. Therefore the sand would be expected to be refractory, and such is the case. The silica content is high, so also is the iron content. The percentage of combined water, not driven off at 110 deg. C. (H_2O+), is also high; therefore the sand would be expected to have "good life," and such is the case. By "good life" is meant the ability to retain its bond strength after repeated use.

The mechanical analysis, as given by Prof. Boswell, is set out in the following table:—

Coarse sand.	*Medium sand.*	*Fine sand.*	*Coarse silt.*	*Fine silt.*	*Clay.*	*Total Sand grade.*
> 0.5 mm.	> 0.25 mm. < 0.5 mm.	> 0.1 mm. < 0.25 mm.	> 0.05 mm. < 0.1 mm.	> 0.01 mm. < 0.5 mm.	< 0.01 mm.	> 0.1 mm.
7.5 per cent.	64.9 per cent.	12.0 per cent.	3.3 per cent.		12.3 per cent.	8.44 per cent.

Austin Laboratories (Tylor Screens).

Mesh. + 35	*Mesh.* + 48	*Mesh.* + 65	*Mesh.* + 100	*Mesh.* + 150	*Mesh.* + 200	*Mesh.* + 270	*Mesh.* − 270
Mm. > 0.417	*Mm.* > 0.295	*Mm.* > 0.208	*Mm.* > 0.147	*Mm.* > 0.104	*Mm.* > 0.074	*Mm.* > 0.053	*Mm.* < 0.053
< 0.589	< 0.417	< 0.295	< 0.208	< 0.147	< 0.104	< 0.074	
0.1 per cent.	1.0 per cent.	8.4 per cent.	64.6 per cent.	7.7 per cent.	1.9 per cent.	0.7 per cent.	1.5 per cent.

Clay. 14.1 per cent.

The outstanding points about the mechanical composition are the high proportion of medium-grade sand, the relatively large quantity of clay and the low percentage of fine-sand grade.

Examination of this medium sand grade shows it to be a good-quality high-silica sand.

Chemical analysis of the sand grade:—

Boswell. Per cent.		*Austin Laboratories.* + 65, + 100, + 150 fraction.	
SiO_2	98.63	SiO_2	99.15
Al_2O_3	0.19	Al_2O_3	0.23
Fe_2O_3 }	0.22	Fe_2O_3 }	0.30
FeO }		FeO }	
MgO	0.12	MgO	Trace
CaO	0.36	CaO	0.15
Na_2O	None	Na_2O }	Trace
K_2O	0.08	K_2O }	
TiO_2	None	TiO_2	0.05
Loss on ignition 0.25.		Loss on ignition 0.18.	

Under the microscope this high purity is confirmed.

The fact, however, that the limonite pellicle around the grain is not burnt on and may easily be washed off by elutriation indicates a lower surface tension between the bond and the grain than that exhibited by the red Bunter sands. Experience on the moulding floor confirms this assumption, as the sand is difficult to patch.

This difference between the Bunter sands and the Belgian yellow may be accounted for by their geological formation. The grains of the red sands, formed under desert conditions, developed roughened surfaces from continued dry abrasion and the dry ferric oxide, readily adhered.

The presence of colloidal-iron hydroxide in the Belgian sand is probably the result of the decomposition of the colloidal mineral glauconite (silicate of potassium and iron and aluminium). The decomposition occurring under conditions the reverse of dry, demonstrated by the absence of the water-soluble potassium. Grains of undecomposed glauconite are sometimes found in this sand. By submitting the Belgian sand to "desert" conditions in the Austin laboratories, *i.e.*, by drying and heating and re-hydrating, it has been possible to reproduce a sand similar to the Bunter reds, in appearance and behaviour, without, of course, containing the harmful soluble alkalies.

The examination of these two sands has revealed the following characteristics, which are briefly tabulated as follow:—

The mechanical analysis of—

RED SAND.	BELGIAN YELLOW.
Reveals a great want of uniformity in grain size of the sand, resulting in a very low permeability.	Reveals a high percentage of the sand of uniform grain size, resulting in a very high permeability for sand of such fineness.

The chemical analysis of—

RED SAND.	BELGIAN YELLOW.
Shows excessive amounts of potassium oxide and sodium oxide in the various grain sizes and in the clay bond, indicating excessive amounts of easily fusible felspars and their decomposition products.	Shows a high silica content in the grain sizes and a low figure for the alkalies in the bond.

The physical analysis of—

RED SAND.	BELGIAN YELLOW.
Indicates a high surface energy between the bond and the sand grain due to burnt on pelicles of ferric hydroxide around the grain.	Indicates a low surface energy between the bond and the sand grain. The pelicles of limonite are loosely held and easily washed off.

Selecting the most desirable characteristics of both was the basis of the synthesis:—(*a*) Silica sands of high purity to be the base grains as in Belgian sand; (*b*) two major grain sizes in the sand so that permeability might be more readily controlled; (*c*) these sand grains to be coated with thin pellicles of ferric hydroxide to increase the surface tension between bond and grains, as in the red Bunter sands. (The silica-sand grains may be selected with the hydroxide envelope naturally occurring or artificially superimposed and burnt-on, which is more satisfactory); and (*d*) the bond to be refractory and to correspond in composition to that of the best steel sand bonds and fireclays, but, in addition, to have a high green bond and a high dry bond.

The selection of the bond was based on a consideration of the properties of two colloidal-clay binders readily available—Bentonite imported from America, and Colbond a domestic product. Colbond has a remarkably high green strength, though not so high as Bentonite. From a series of tests carried out at concentrations likely to be used in the systems, the green bond strength of Bentonite and Colbond were found to be in the ratio of

Bentonite	5
Colbond	3

However, keeping in mind the original purpose of the investigation—to develop a synthetic sand suitable for a mechanised grey-iron system, a mechanised-steel system and a jobbing floor—it was decided to operate with Colbond.

An examination of composition and properties of the two binders, shown in Table IV, reveals the reasons for the choice.

The fusion point of Colbond is remarkably high, as indicated by Dr. Mellon's figures, given below, obtained from the constituent clays of this preparation.

As a comparison the fusion points of clay bonding material of naturally-bonded moulding sands is included; this table (Table V) is taken from a Paper on "Sands and Sand-Testing" by J. G. A. Skerl, D.Sc., F.G.S., given at the 28th Annual Convention of the Institute of British Foundrymen, June, 1931.

Having decided on the clay bond and type of sands to be used, the synthetic sand was put into production.

Several good silica sands were available, and an Erith silica sand of medium grain size and a Leighton Buzzard sand of fine grain size were selected. The following is the mechanical analysis of these sands.

*Erith Silica.** I.M.M.		*Leighton Buzzard.** I.M.M.	
+ 30 mesh	0.9 per cent.	+ 40 mesh	0.1 per cent.
+ 40 ,,	12.0 ,,	+ 50 ,,	0.8 ,,
+ 50 ,,	28.7 ,,	+ 70 ,,	11.4 ,,
+ 70 ,,	46.6 ,,	+ 100 ,,	45.4 ,,
+ 100 ,,	9.4 ,,	+ 150 ,,	36.6 ,,
+ 150 ,,	1.7 ,,	+ 200 ,,	3.0 ,,
+ 200 ,,	0.4 ,,	− 200 ,,	1.0 ,,
− 200 ,,	0.3 ,,	Clay	1.9 ,,

* I.M.M. Screens were used in these later determinations, to conform to the more general practice in this country.

	Yellow.	Red.	Black.	Mixture of equal parts of yellow red and black.
Cone	17	17	18	18
Centigrade	1,480	1,480	1,500	1,500

(The above determinations are the work of Dr. J. W. Mellor)

Later a silica sand from the Bedford deposits was substituted for the Erith, when the investigation showed the advantage of the ferric hydroxide which was found naturally occurring around each grain of this sand (equivalent in amount to 0.90 per cent. Fe_2O_3).

The following is a résumé of the resulting sand practice.

Facing Sand Preparation.

Using 14 parts spent backing sand by volume.
4 ,, Leighton Buzzard Sand by volume.
¾ ,, Colbond by volume.
1¼ ,, coal dust by volume.

TABLE III.—*Chemical Analyses of Bunter Moulding-Sands.*

Percentage weights.

Page.		SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O+	H_2O-	CO_2.	TiO_2.	ZrO_2.	P_2O_5.	SO_3.	Cl.	MnO.	BaO.	Total, etc.
167	Aughton Park, Ormskirk	92.30	3.94	0.34	0.15	0.16	0.12	0.03	2.14	0.56	0.34	n.d.	0.19	none	trace	n.d.	trace	trace	0.02	100.29
169	Belfast, Knockvale ..	81.47	8.84	1.84		0.81	0.86	1.50	2.78	Ign. 2.24			0.35	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.69
171	,, Lagan Vale ..	74.80	7.70	1.13	0.56	1.33	4.55	1.34	2.65	1.18	0.50	3.52	0.30	n.d.	0.04	0.02	trace	0.04	0.04	99.70
155	Birmingham, Hockley Cemetery, close ..	84·86	6.69	1.08	0.35	0.43	0.29	0.40	3.41	1.21	0.55	none	0.40	trace	0.09	none	trace	0.01	0.04	99.81
160	Compton, near Wolverhampton (bulk) ..	86.37	6.40	0.96	0.25	0.42	0.26	0.36	3.25	1.00	0.57	none	0.35	trace	0.06	none	trace	0.01	0.04	100.30
160	Compton, medium sand-grade (MS)	94.37	2.82	0.46		0.17	0.16	0.12	1.57	Ign. 0.48			0.06	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.21
160	Compton, fine sand-grade (FS)	89.10	5.32	0.88		0.28	0.24	0.15	3.13	0.71			0.21	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.02
160	Compton, coarse silt-grade (cs)	85.31	6.95	1.23	0.22	0.37	0.41	0.49	3.31	1.43			0.43	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.15
160	Compton, fine silt-grade (fs)	69.05	14.15	2.70	0.53	1.05	1.27	0.56	5.45	4.28			0.97	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.01
160	Compton, clay-grade (c)	58.17	19.58	5.47	0.55	1.78	1.34	0.38	5.37	6.34			0.73	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	99.71
149	Heck, near Selby ..	87.14	5.89	1.00	0.29	0.41	0.25	0.14	2.95	1.00	0.55	none	0.18	0.02	0.08	0.03	trace	0.02	0.03	99.98
164	Kidderminster, Station Pit	85.66	6.59	0.86	0.36	0.55	0.26	0.16	3.41	1.22	0.74	none	0.40	trace	0.10	none	trace	0.01	0.03	100.35
65	Mansfield, pig-bed sand	88.60	5.40	1.08	0.22	0.28	0.18	0.06	2.49	1.06	0.28	none	0.19	n.d.	none	none	trace	0.02	0.01	99.87
65	,, lower medium	82.51	4.96	0.97	0.30	1.56	2.39	0.10	2.20	1.29	0.47	2.92	0.17	n.d.	0.07	none	trace	0.02	trace	99.93

Mixing for 3 min. dry and 4 min. wet, gave the figures of :—

Strength	8 lbs. per sq. in.
Permeability	50 „ „ „
Moisture	5 per cent.

The Colbond additions were calculated from laboratory determinations, but as the strength resulted in considerable economy, apart from the reduction in scrap obtained.

It has also revealed very important surface energy effects between bond and sand grain, dependent mainly upon the physical condition of the sand grain. It is intended to pursue this subject further, as this synthetic system has already indicated further economies and some remarkable possibilities. An example will illustrate this.

It is possible to burn on the sand grain many more materials (preferably refractory materials) which will increase the surface tension between grain and bond and increase the green and dry-bond strengths of the sand; manganese compounds are an instance. These are:—

(1) *Manganese resinate* added to the linseed oil will decrease the drying time of the cores.

(2) *Manganese compounds* will be burnt on to the grains by the heat of the metal on the cores and subsequently by the heat of the metal on the moulding sand.

(3) In steel moulding, *manganese silicate* will be formed at the surface of the mould, and the stripping of the casting made to resemble or improve upon the easily-stripped moulds in manganese-steel castings.

The results of such additions are:—(1) An economy in the core shop, (2) an economy in clay bond, and (3) an economy in the fettling shop.

The burning-on of aluminium hydroxide to the sand grain suggests even other advantages apart from its desirability as a refractory and its suitability as an addition to siliceous clay binders, such as gelatinous compound, should have high surface-energy effects.

It is felt that, while this subject has many possibilities, it is most inadequately treated in this Paper, but time did not permit the confirmation of many interesting results, and only

(*Concluded on page* 415.)

Table IV.—*Chemical Analysis of Colloidal Clays.*

Bentonite A.		Bentonite B.		Colbond.	
Silica	62.57	Silica	57.98	Silica	61.57
Alumina	22.45	Alumina	22.46	Alumina	18.56
Iron oxide	3.89	Iron oxide	3.92	Iron oxide	3.08
Lime	0.75	Lime	1.92	Titanic oxide	0.96
Magnesia	2.46	Magnesia	3.24	Lime	1.07
Sulphur	0.30	Sulphur SO_3	0.75	Magnesia	0.62
Chlorides	0.20	Chlorides	—	—	
Loss on ignition ..	6.18	Loss on ignition	7.93	Loss on ignition	13.41
Alkalies	0.80	Alkalies	1.35	Alkalies	0.65
Fusion Points.					
1,340 deg. C.		1,275 deg. C.		1,500 deg. C. to 1,480 deg.C.	

Table V.—*Chemical Analyses and Refractoriness of the Clay-bonding Material in Sands.*

Sand.	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	Alks.	Loss on ignition.	Fusion point in deg. C.
									Deg.
Southampton—Badenham	54.02	16.65	14.75	0.58	0.39	1.06	2.35	10.20	1,330
„ Westwood	53.90	20.08	10.40	0.85	0.44	1.88	2.15	10.30	1,380
Erith—Mild loam	57.23	11.12	8.51	0.54	0.45	1.17	1.13	19.85	1,320
„ Yellow loam ..	55.60	9.75	11.69	1.14	0.41	1.08	1.78	18.55	1,370
„ Medium loam ..	54.49	11.98	7.36	0.78	0.55	1.70	1.04	22.10	1,315
„ Strong loam ..	62.16	11.48	6.29	0.68	0.93	1.50	0.94	16.02	1,295
„ Extra strong loam	57.34	13.21	6.59	0.54	0.94	1.62	0.98	18.78	1,330
Pickering	72.59	13.04	4.40	0.22	0.62	0.81	2.74	5.58	1,270
Bromsgrove—Top bed ..	52.13	23.71	8.93	0.48	0.36	2.33	2.84	9.22	1,390
„ Middle bed	53.76	25.39	6.94	0.62	0.34	2.06	3.12	7.77	1,400
„ Bottom bed	55.63	24.64	6.82	0.70	0.44	1.90	2.43	7.44	1,415
Kingswinford—Top bed ..	56.95	23.24	8.00	0.60	0.52	2.08	1.56	7.05	1,320
„ Middle bed	55.46	23.37	8.70	0.85	0.37	1.97	1.98	7.30	1,360
„ Bottom bed	56.07	24.20	8.19	0.71	0.45	1.17	1.34	7.25	1,380
Scottish—Avenuehead ..	54.25	26.66	2.50	0.64	1.02	1.71	3.20	10 02	>1,400
„ Greenfoot ..	52.89	31.41	2.40	0.33	0.36	0.10	3.97	8.54	>1,400
„ Loudoun ..	54.26	27.51	4.09	0.32	0.20	0.15	1.29	12.18	>1,400

figures steadily increased the amount was later reduced to 2/3 parts.

Backing Sand Preparation.

Using 14 parts of spent backing sand and
1 part of Erith silica sand (by vol.).

Mixing for one min. gave the following figures :—

Strength	6 lb. per sq. in.
Permeability	60
Moisture	4.5 per cent.

Later the Erith silica sand was substituted by spent core-sand (mixture of Erith and Leighton Buzzard sand), this being one of the intentions necessitating the investigation.

Again, it is intended to substitute the new sand additions to the facing sand by spent core-sand. This latter substitution is awaiting the installation of a sand recovery plant using Hummer screens—then the finer separation may be added to the facing sand and the coarser separation may be added to the backing sand.

That the present synthetic sand is giving satisfaction may be gathered from Table II, showing the reduction of scrap due to sand defects.

No spent sand is now being dumped; the new sand additions are, however, higher than the grey-iron system requires, and the extra sand is necessitated by shop requirements in moulding sand, mainly as " drier " sand for cores used in the jobbing grey iron and steel sections, and that the jobbing floor is now drawing from the grey-iron-sand system for sand for special work.

The suitability of this synthetic sand in the steel system is illustrated by photos of unfettled castings, Fig. 10 showing castings made in (*a*) natural moulding sand and (*b*) synthetic sand.

This investigation " to develop a moulding sand that would operate successfully as a grey iron, a steel and a jobbing-floor sand, and to make the basis of this sand, burnt sand which has already functioned in oil-sand cores " has

Fig. 10.—Castings made in (a) Natural Moulding Sand, and (b) Synthetic Moulding Sand.

Inscriptions to Figures on page 413.

Fig. 11.—The Smaller Grain Size of Bromsgrove Red Sand Washed Repeatedly with Water, showing the Majority of the Grains with Ferric-Hydroxide still adhering.

Fig. 12.—The Larger Grain Size of Bromsgrove Red Sand Washed with Hcl.

Fig. 13.—Bromsgrove Red Sand with Clay Bond adhering.

Fig. 14.—Erith Silica Sand as naturally occurring, showing Absence of Ferric-Hydroxide Pellicles.

Fig. 15.—Erith Silica Sand with Precipitated Ferric-Hydroxide burnt on, showing one remarkably Smooth Grain to which the Precipitated Ferric-Hydroxide evidently did not adhere.

Fig. 16. — Erith Silica Sand with Ferric-Hydroxide and Clay Bond Additions.

Fig. 17.—Leighton Buzzard Silica Sand, showing by Contrast with Fig. 14, Erith Silica Sand, a Thin Pellicle of Ferric Hydroxide, in this instance Colloidal Limonite.

Fig. 18.—Water-washed Sand Grade of Belgian Yellow Moulding Sand.

Fig. 19. — Belgian Sand Grade with Bond adhering.

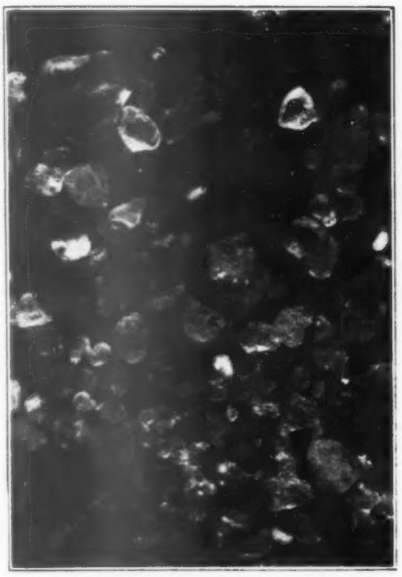


FIG. 11.

FIG. 12.

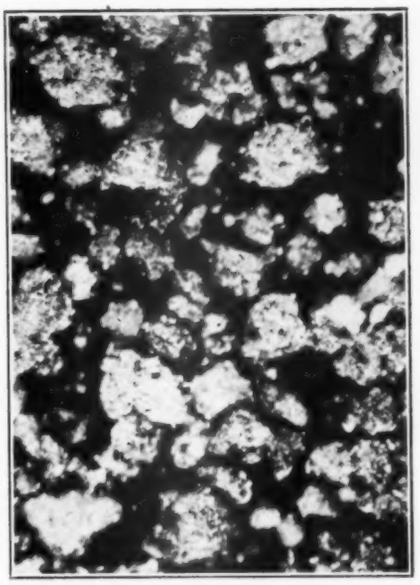


FIG. 13.

FIG. 14.

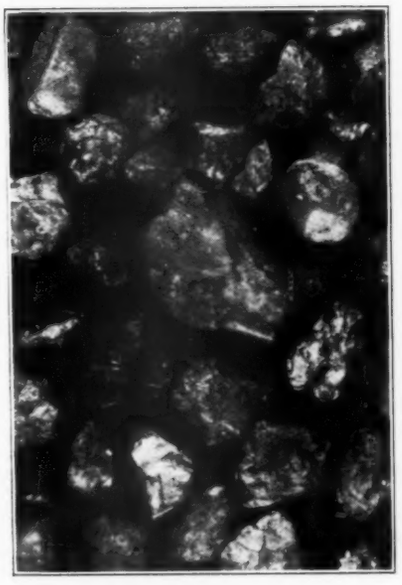


FIG. 15.

FIG. 16.

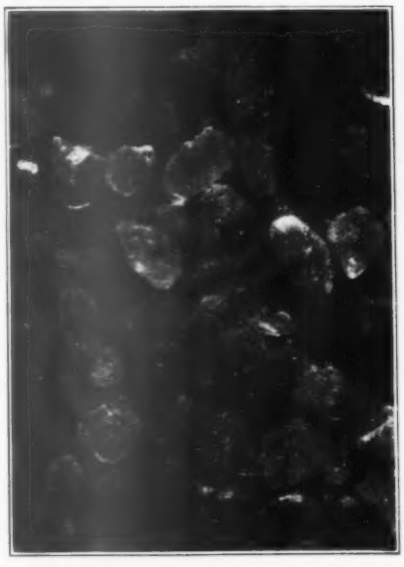


FIG. 17.

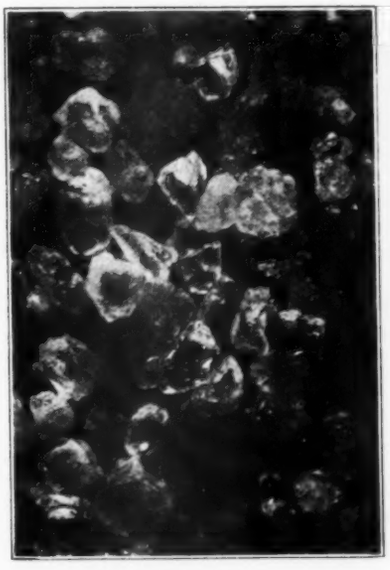


FIG. 18.

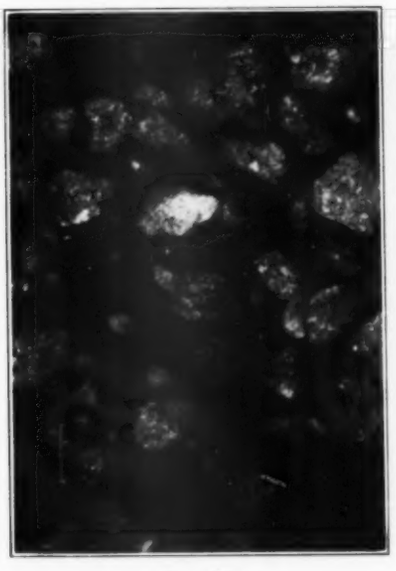


FIG. 19.

(*For inscriptions to figures see page* 412.)

Non-Ferrous Foundry Practice

DISCUSSION AT MANCHESTER CONFERENCE

A session was set apart at the Manchester Conference of the Institute of British Foundrymen to discuss Mr. C. M. Saeger's Paper on Cast Red Brass, which was presented by Mr. V. Delport, and Studies on Cast Bronzes by Mr. F. W. Rowe. The former appeared in our issues of June 7 and 21 and the latter on June 7.

Cast Red Brass

MR. J. E. HURST (Vice-President) was in the chair, and said that before the discussion opened he thought it was very necessary to place on record an appreciation of the Institute of British Foundrymen of the American Foundrymen's Association kindness in sending the Exchange Paper. He presumed that Mr. Delport would be able to convey that expression of appreciation, and he suggested that it should be shown in the usual manner. A unanimous expression of thanks to the American Foundrymen's Association was then carried by acclamation.

The CHAIRMAN, continuing, said that the second thing they ought to do was to show their appreciation of the very able abstract that Mr. Delport had presented of the Paper. He had picked out, with unerring accuracy, the salient points of the Paper.

MR. J. S. G. PRIMROSE said that as Convener of the Non-Ferrous Casting Sub-Committee of the Technical Committee of the Institute he had much pleasure in welcoming the Paper from their American colleagues. It covered to a very large extent one of the series of alloys which came in the purview of their present investigations. As a Committee they would very carefully consider it and endeavour to incorporate some of its thoroughness into the work that they were at present doing.

The author of the Paper had given details in a way which proved very clearly how many factors of variation could take place in the casting and testing of the materials dealt with. One point he was very pleased to notice was that he had eliminated any possible doubt of his tensile values by using a precision-testing machine, concerning the merits of which there could not be any doubt at all.

Graphic Representation

Another point he would like to raise was that the author had presented his graphs in a slightly different way from that associated with British practice. In order fully to realise what those graphs meant some of them would have to re-plot them on points and join them. Instead of having one graph showing four things they would have to prepare four graphs in order to obtain an idea of how the properties varied with the different conditions.

Casting Stresses

He was very pleased to see the macrophotographs and photomicrographs produced. These seemed to indicate that the American type of test bar did leave an internal stress in the middle, with, of course, correspondingly slight reduction in the recorded tensile due to this factor. Against that he would like to mention that the Institute's Sub-Committee had adopted two sizes of test bars, not to represent the castings, but with the object of getting what they hoped would be the maximum value out of the alloy so cast. So far the results obtained from the various members of the Committee had gone to prove that they were effective test bars for similar alloys to those dealt with in the Paper, and that in the case of the leaded gunmetals and of the leaded phosphor bronzes, much higher tests had been obtained than had ever before been recorded for such materials.

A very great number of specifications had been brought to the notice of the Sub-Committee, and the general object of the work done had been to reduce that number. The author of the Paper had mentioned that about 40 American specifications could be concentrated into the one dealt with. The Sub-Committee, in a wider field, had taken about 200 British specifications, and had endeavoured to get them within the space of five alloys which were at present being investigated. It had been hoped to give some of the findings of the results at the present meeting, but the ramifications of the tests were so great that it was felt that the Sub-Committee would not be justified in making any publication at present. The work was still going on.

One point he thought he might mention was that they were making a comparison of bars made as both dry-sand casting and green-sand casting. Mr. Saeger had confined most of his bars to green sand and chill cast. The Sub-Committee had not done chilled cast or immersed crucible work, which latter seemed to overcome the difficulty that stresses were left in the test bar, and these were, of course, rather detrimental to getting uniform or accurate results.

The Test Bar Position

MR. F. W. ROWE also wished to join in the general hearty appreciation of the excellent work that had been described in Mr. Saeger's Paper, and also of the attitude of the American Foundrymen's Association in letting them have such a very excellent piece of work for the consideration of the members of the Conference, and an opportunity to digest in detail all the multitudinous results Mr. Saeger had obtained. Mr. Primrose had mentioned the work which was being done in this country by the Non-Ferrous Metals Sub-Committee of the Institute of British Foundrymen. Speaking as a member of that Sub-Committee he desired to amplify, and possibly to clarify, one or two of the remarks Mr. Primrose had made with regard to the work of the Sub-Committee. He did not entirely agree with his remarks regarding the work which was being done with respect to the designation and selection of a more suitable size and form of test piece for non-ferrous metals. Primarily, he, the speaker, considered that it was not essential to select the size and form of test piece particularly to give the highest physical properties of which the alloy was capable. He had not understood that that was one of the objects of the Sub-Committee. The main idea was to produce a form of test piece which would give the most uniform results when used in a large number of foundries, and to give also a type of test piece which was easily made under standardised conditions by any type of foundry. Personally, had he been setting out to design a test piece which would give the maximum physical properties of the alloy under specified conditions, he thought he could have got something rather more complicated, and which would give rather better physical properties, but one which would not be adaptable to put out to all classes of foundry.

He was pleased to find that the Paper had demonstrated clearly what the members of the Non-Ferrous Sub-Committee of the Institute of British Foundrymen had felt for some time, namely, that the fin-gate type of test piece which had been sponsored and used by the American Foundrymen's Association was not one which was calculated to give a really good result under all conditions, and that it possessed several inherent defects which were shown up in the Paper.

He thought also that the American Foundrymen's Association would be well advised to consider if the specifying of test bars cast in green sand was not likely to lead to non-uniform results throughout the industry. Personally, he considered that if a dry sand mould was used, one was much more likely to secure uniform conditions in various foundries than if a green sand mould were used.

Effect of Sulphur

He would like also to utter a word of warning with regard to the results of the effect of sulphur on this particular alloy, and also on brasses and cast brasses and bronzes in general. Anyone not fully acquainted with the subject in respect to the effects of sulphur would be likely, on reading the Paper, to consider that sulphur up to 0.1 per cent. had no appreciable effect on this type of alloy provided the casting temperature was kept below 1,260 deg. C. He submitted that this was not proved in the Paper. It had been certainly proved that by adding stick sulphur to a melt no deleterious results were obtained, but he suggested that this method of adding sulphur did not bear relationship to what actually occurred in a foundry. Anyone reading the Paper would be apt to presume that sulphur was not detrimental. The most usual form in which sulphur was introduced into a bronze was by contamination with sulphurous fuels, in which case the sulphur usually entered the metal in the form of sulphur dioxide or sulphur trioxide as a gas. Under such conditions, if the author of the Paper had studied the effect of the addition of sulphur by means of sulphur dioxide or sulphur trioxide, the results would have been very different, and would have shown that a deleterious result was obtained. Adding stick sulphur was hardly likely to obtain in any form of foundry practice.

He agreed with Mr. Primrose that the presentation of the results of the author's research work in the form in the Paper was one to which they were unaccustomed in this country. While for many types of results, it was one that was admirable, he did not think that it was one which was the best for this particular class of work, nor was it the best way of indicating the differences which arose. The presentation of the results in the form of curves would have been more easily understandable, and, personally, he would have to do what Mr. Primrose had already suggested, namely, re-plot the figures in the form of the more usual graphs.

Casting Temperature

There was also another point he would like to make, that in studying the effect of casting temperature with this alloy the minimum casting temperature used might have been extended a little lower down in the scale, because the Paper did not so far give any great indication as to the troubles which might arise from sinking too low. The low strengths and low general physical properties which arose from a high casting temperature were very well known, but there was also a similar sort of happening at the other end of the scale which was not even hinted at in the Paper.

He did not wish to set himself up as disagreeing with the results which had been obtained, nor in any way detracting from the very great value of the Paper. A further continuance of the work would be of very great service to the industry at large.

Is Standardisation Desirable?

MR. V. C. FAULKNER (Past-President) observed that it seemed to be assumed that standardisation was a thing to be welcomed. Correlated with standardisation of non-ferrous alloys was the dual question of patents and trade marks. He threw out the suggestion that a foundry manager would take a greater personal interest in an alloy bearing a trade mark rather than

one which was just called red brass. He was not quite convinced in his own mind that they were going on right lines in translating all alloys into common or garden B.S.I. specifications, and he would like some of the speakers who followed him to touch on that point.

The CHAIRMAN remarked that Mr. Faulkner had raised quite an important point. He wondered if any of the other speakers, or perhaps some members of the Non-Ferrous Committee, would comment on the immersed crucible method of making test bars?

Too Many Specifications

MR. A. LOGAN said that Mr. Faulkner had raised a very important point. Personally, he had marked a passage in the Paper which he thought was a very remarkable parallel to the work of the Non-Ferrous Sub-Committee. It was stated in the introduction that "As a result of a survey made, it was found that over 600 so-called common alloys were in use, and, in addition, many special alloys that are usually classed as high strength alloys. Tentative specifications have been promulgated and approved by the American Society for Testing Materials covering twenty non-ferrous alloys. It is believed that these, to a very large degree, may be used in place of the more than 600 now in use." He thought that statement was an answer to Mr. Faulkner. If it were possible to reduce 600 alloys, by means of standardisation, down to 20 alloys which would do exactly all, and probably even more than, the 600 would, then a great step forward had been taken. Take the case of a non-ferrous foundry. Orders were being received from day to day from a variety of customers, involving 600 compositions which sometimes varied by only a quarter per cent. Buyers specified what they wanted, and exactly the properties required, and insisted upon getting them. Imagine the chaotic position of a foundry with 600 compositions to deal with.

This aspect of the work of the Non-Ferrous Sub-Committee had been particularly pushed forward during the past two years with the object of simplifying every-day foundry working. There were dozens of different compositions in common use, and, being asked for every day, many of which were quite unnecessary, half-a-dozen alloys would do all that these multi-compositions would do. It was a very important point in regard to economical working, and generally speaking the standardisation of alloys would simplify matters all round. It would give engineers, for instance, a definite picture of what they could expect and of what they would know they would get; whereas he was certain that in many cases people who were specifying certain compositions had no idea what they were asking for or why they were asking for it. Probably other speakers would indicate more completely to Mr. Faulkner exactly what was involved in the standard alloys idea, nevertheless he felt very strongly about it, as it was a problem that was being met every day.

Running Properties

The next point he wished to raise was quite a new one as far as he was concerned. He had not seen it mentioned in connection with non-ferrous work before. He referred to the Measurement of Running Properties. It was becoming common ferrous practice to have a "running" or "flow" or "fluidity" test. He understood that the actual term was still a matter of controversy in the Cast Iron Committee of the Institute; but he thought this was the first indication he had had of it being actually applied in a brass foundry. "The running properties of the alloy were studied by the method described by Saeger and Krynitsky, which consists essentially in casting in a green-sand mould a small spiral strip of uniform parabolic cross-section. The length of the spiral is taken as an indication of the relative flowing properties of the metal under the conditions used." One remarkable thing to which he wished to direct attention was shown in Fig. 11—"Running properties of Red Brass made from Virgin metal and Remelted Metal cast in Green-Sand Moulds." Apparently the remelted red metal had a greater fluidity than the original virgin material. There was an exception at 1,205 deg. C. about which no comment was made. It seemed to be a remarkable exception. The general experience was for the re-melted metal to be higher in fluidity than the virgin metal. He would like further information upon the point. It was a moot point whether the fluidity test was of any practical value in the foundry.

As a result of the many uncontrolled variables, it could not be the criterion of pouring temperature. He did not see any real practical foundry significance in a fluidity test, though possibly it was of academic value.

Casting Temperatures

The summary of the Paper set out the conclusions very clearly. One of the main features mentioned with the alloy was common to all non-ferrous alloys, and that was the importance of the pouring temperature. This was the one factor in non-ferrous work which was of paramount importance.

One strange thing was that the properties of test bars made of virgin metal or re-melted metal were alike. It was not stated, however, how many re-melts the material had had; presumably only one re-melt. Would the same conclusions apply if the material was re-melted 10 times?

The question of sulphur in connection with red bronze had been dealt with already by Mr. Rowe, and he too would like to query the author's conclusions. As Mr. Rowe had pointed out, this rather minimised the effect of sulphur, and one might get the impression that the sulphur was of little or no importance or practical effect. This might be correct with regard to the particular method adopted for adding sulphur, but it was rather dubious as to universal application.

B.S.I. Standards Advocated

DR. J. W. DONALDSON said that with regard to standardisation of alloys, he could not agree with Mr. Faulkner, and he thought Mr. Logan had referred to the matter in a very satisfactory manner. As metallurgist to a large engineering firm, he was frequently consulted as to the composition of alloys required for various specifications, and he always advised the adoption of the B.S.I. Specification where such a specification existed. He was of the opinion that there ought to be more standard specifications for alloys both ferrous and non-ferrous. In testing, test bars ought also to be standardised as well as the method of testing. Much of the work which had been done of recent years was useless, because it was not suitable for comparative purposes.

The Non-Ferrous Sub-Committee were considering not only standardisation of certain alloys, but also standard test bars and standard methods of casting.

In the Paper reference had been made to the influence of sulphur on the alloys tested. He could not agree with the conclusions arrived at. He had always found sulphur to be detrimental. The manner in which the sulphur had been added to the alloys and the form in which it occurred in the alloys was not the manner in which sulphur was absorbed and retained in non-ferrous alloys, when prepared in the foundry under normal conditions.

Standardising Casting Temperatures

MR. A. HOPWOOD wished to remind the previous speaker that the standardisation of casting temperatures for any type of alloy depended on the type of casting and foundry technique. It was, however, a practical proposition to standardisee for any one job, including the method of moulding and running.

DR. DONALDSON said he did not wish to standardise casting temperatures in the foundry, but to standardise casting temperatures when various workers were making comparative tests on an alloy or alloys.

MR. A. HARLEY (Past-President) referred to the multiplicity of alloys. The whole of the copper alloys required in the automobile industry, as far as the firm with which he was associated was concerned, amounted to six. That covered all the requirements not only for commercial vehicles but also for ordinary touring cars. It was quite obvious they could not afford to have many more in a foundry where the scrap had to be carefully segregated. More than six would raise almost an impossible problem. When one considered the hundreds of parts of a car or a motor coach that were made in copper alloys it was evidence that 95 per cent. of the 600 alloys mentioned were unnecessary.

Dr. Donaldson had corrected a point he was going to raise with regard to the standardisation of pouring temperatures. Every job seemed to require its own temperature, and it was necessary to find the most suitable temperature for that job. This consideration was, of course, influenced by the method of running; getting the metal in at the proper temperature without mis-running the casting.

Although perhaps it was not altogether a matter which was relevant to the Paper, yet, as a brass founder, he felt that more attention should be concentrated on the melting of the metal. It was not good to over-heat the metal, and then pour at the right temperature. Very much better results could be obtained.

(To be concluded.)

Recent Developments in British Synthetic Moulding Sand Practice

(Concluded from page 412.)

those repeatedly confirmed are mentioned. Further work is in progress. It is believed, however, that more rapid progress in the study of this subject could be made with the co-operation of interested members of the Institute of British Foundrymen. For this reason the preliminary findings are given here in the hope that such interest will be stimulated.

As an appendix, photographs of the sands used in the investigation have been included.

The author wishes to thank the Austin Motor Company for permission to publish this Paper, and very particularly to thank the staff of the Austin foundry and laboratories for their indispensable co-operation in the work entailed in preparing this Paper.

Valves for Handling Corrosive Substances

Valves for handling corrosive substances have received a good deal of attention in recent years, and many tests have been made, under both laboratory and works conditions, in an endeavour to find a material with improved life at reasonable cost. Very good service has been obtained with austenitic nickel-alloy cast irons of the Ni-Resist type, and some interesting results are available from America. In one instance a valve of cast iron of the Ni-Resist type, used in contact with sulphuric acid (58 to 60 deg. Baumé) in a fertiliser plant, was still in good condition after fourteen months' use, ordinary cast-iron and bronze valves having failed after only a few weeks. Again, a Ni-Resist valve, used in an oil refinery for handling heavy acid sludge at about 90 deg. C., was found to be in excellent condition after twelve months' service, ordinary cast-iron valves having had a life of from three weeks to three months.

This Week's News in Brief

Trade Talk

THE ADDRESS OF Foundry Plant & Machinery, Limited, has been changed from Wellington Street to 113, West Regent Street, Glasgow, C.2.

THE FIRST ANNUAL MEETING of the Institute of Vitreous Enamellers is to be held in Birmingham early in October, under the presidency of Dr. Mellor, F.R.S.

MESSRS. SIR WILLIAM ARROL & COMPANY, LIMITED, Glasgow, have received the contract for the demolition of Waterloo Bridge over the Thames. The value of the contract is over £200,000.

MESSRS. BARBER, WALKER & COMPANY, LIMITED, Nottingham, have placed an order for coke ovens and by-product plant for their Harworth Colliery with Messrs Simon-Carves, Limited, Cheadle Heath, Stockport.

AS A RESULT of improved trade, Messrs. R. A. Lister & Company, Limited, engineers, of Dursley, have decided to give a week's holiday on full pay to all their employees who have completed a full year with the firm.

MR. J. G. PEARCE, Director of the British Cast Iron Research Association, delivered the opening Paper to the recent Conference of the Association of Technical Institutions on a "National Scheme of Foundry Education."

MR. M. MAIR, M.C., M.INST.C.E., of Newton-Stewart, Ayrshire, has been appointed deputy-chief engineer in the East Indian State Railway, and is to be in charge of the reconstruction work on the railway in the area which was devastated in the recent earthquake.

AT THE FALKIRK DEAN OF GUILD COURT this week a petition was submitted by the Forth & Clyde & Sunnyside Iron Company, Limited, craving warrant to make additions to their office buildings and to make internal alterations at their Sunnyside Works. The warrant was unanimously granted.

THE WELFARE CLUB of the Larbert Art Metal Company, Limited, and the Scottish Enamelling Company, Limited, held a successful outing on June 16. The party travelled by motor-coaches to St. Andrews, where during tea gifts were made to Miss Sorenson and Mr. Flint, who were responsible for the organising of the outing.

MESSRS. A. & W. SMITH & COMPANY, LIMITED, Glasgow, have secured an order for the equipment of two new sugar factories in India, each capable of crushing 850 tons of sugar cane daily. The buildings will be fabricated in India, for which about 3,500 tons of steel will be supplied from Glasgow. The value of the contract is approximately £135,000.

MESSRS. D. & W. HENDERSON & COMPANY, LIMITED, Meadowside, Glasgow, have secured an order from Messrs. Salveson & Company, Limited, Leith, for a cargo steamer of 9,000 tons deadweight for the owners' Scandinavian services. The boilers and machinery will be supplied by Messrs. Henderson, who, as a result of this contract, will now be in the enviable position of working to full capacity.

A DEAL OF CONSIDERABLE IMPORTANCE and significance is contemplated in an offer which has been made by Sir James Lithgow, the prominent shipbuilder and industrialist, to purchase the shares of the Steel Company of Scotland, Limited, which has an issued capital of £500,000 in £10 shares. The offer is now under consideration, and it will be a little time before it is known how the offer is received by the company.

IT IS ANNOUNCED that the Dennystown Brassworks Company, Limited, are to close, and that a liquidator has been appointed. The works were established more than 70 years ago, and were well known in brassworks circles in the Clyde area. About 30 years ago a limited company was formed, and the late Mr. John Macpherson became managing director and continued in that position until his death in the early part of this year.

LAST THURSDAY the foundation stone of Fulham's new power station was laid by the Mayor of the Borough. The steel framework is already in position. In this structure 17,000 tons of steel has been used, all of which was fabricated, delivered to the site and erected by Messrs. Dorman, Long & Company, Limited, in the short space of 33 weeks, an average of 515 tons per week for over eight months. In the new building machinery will be installed with a capacity of 130,000 kilowatts, which will ultimately be developed to 300,000 kilowatts.

Personal

MR. OLIVER SMALLEY, British Vice-Consul at Pittsburg, U.S.A., expects to arrive in England in the near future.

MR. F. M. GAUSSEN, foundry manager, the Vickers Commonwealth Company of Australia, is paying a business visit to this country.

MR. PERCY PRITCHARD, managing director of the Midland Motor Cylinders, Limited, is at present making a business trip in the United States.

MR. A. H. MOORE AND MR. F. W. HOBBS, proprietors of the Standard Brass & Iron Foundry, Limited, Benoni, Transvaal, are due to arrive in London next week.

MR. B. B. KENT, general manager of the Sterling Manufacturing Company, Cubitt Town, has returned to England after an extended tour of the vitreous enamelling centres in America.

MR. H. B. TOY, who has been re-elected President of the Tees-side Chamber of Commerce, is one of the most prominent foundry-owners on the North-East Coast. At his works, the British Chilled Roll & Engineering Company, Limited, both roll manufacture and steelfoundry practice are carried out. He is assisted in the conduct of this enterprise by his son, Mr. S. V. Toy, who takes a profound and personal interest in the Institute of British Foundrymen, having presided over the Middlesbrough Branch shortly after its creation in 1924. Mr. H. B. Toy is a past member of the Council of the Iron and Steel Institute, where he very often had to act as the representative of the ironfounding industry. In his presidential address to the Tees-side Chamber of Commerce Mr. Toy made a plea for the introduction of new industries to the district, especially those connected with the finishing of automobile and aircraft parts. He himself had never regretted the creation of a new local industry, that of roll-founding, some 27 years ago. We congratulate Mr. Toy on his re-election and sincerely hope that he will have a successful year of office.

MR. H. B. TOY.

FOUR LEADING SCOTTISH STEELMAKERS have been nominated by the Scottish members of the British Iron and Steel Federation for the national council of that body. They are Mr. John Craig, Colvilles, Limited; Mr. K. D. MacKenzie, Fredk. Braby & Company, Limited; Mr. A. K. McCosh, Messrs. William Baird & Company, Limited; and Mr. H. C. Waterson, of the Scottish Iron & Steel Company, Limited.

Will

KENNARD, CAPT. MALCOLM A., R.N., retired chairman of the Falkirk Iron Company, Limited £38,928

Company Reports

Greenwood & Batley, Limited.—Final dividend on the ordinary for the year to March 31, 1934, of 3½ per cent.

Edgar Allen & Company, Limited.—Profit of £1,001, which reduces the debit balance to be carried forward to £76,825.

John Baker & Bessemer, Limited.—Dividend on the 6 per cent. cumulative preference shares for the half-year ended June 30, 1932.

Millom & Askam Hematite Iron Company, Limited.—The directors have decided to withhold payment of the preference dividend.

Thos. W. Ward, Limited.—Following the dividend payment made on March 31 last, the directors announce their intention to pay a further one year's dividend on the first preference share capital, i.e., for the twelve months ended June 30, 1933.

Hick, Hargreaves & Company, Limited.—Loss for year to March 31 last, £217; net loss after providing for depreciation, debenture interest and income tax, £6,795; brought in, £1,539; from reserve, £7,000; dividend at the rate of ½ per cent., £1,200; carried forward, £543.

Whitehead Iron & Steel Company, Limited.—Net profit, after placing £20,000 to depreciation reserve, £6,900 to taxation reserve, and making provision for renewals of plant and works, £73,733; brought in, £10,032; final dividend of 10 per cent. (actual), making 15 per cent. for the year; to general reserve, £15,102; carried forward, £11,805.

John Brown & Company, Limited.—Gross profit, £78,308; dividends and interest in respect of previous years and taxation adjustments, £13,295; transferred from reserve for certain contingencies no longer required, £53,000; net revenue balance after debenture interest, depreciation and fees, £2,899, which increases the carry-forward to £18,471.

Bradley & Foster, Limited.—Net profit, £9,424; taxation, £2,427; depreciation reserve fund, £5,500; brought in, £3,261; interim dividend on preferred ordinary shares at 3 per cent. actual, less tax, £150; final dividend on preferred shares at 4½ per cent., £221; dividend on ordinary shares for year at 2½ per cent., less tax, £968; carried forward, £3,417.

Guest, Keen & Nettlefolds, Limited.—Full report shows:—Net credit balance, after charging debenture interest and providing £33,830 against profits for redemption of debenture stock, £324,959; depreciation, £50,000; brought in, £500,723; available, £775,683; interim dividend on the first preference shares at the rate of 5 per cent. per annum for the six months ended September 30, 1933, free of tax, £45,500; interim of 6d. per share, free of tax, on the second new preference shares, £117,865; dividend on the first preference at 5 per cent., free of tax, for the six months ended March 31, 1934, £45,500; dividend on the second preference at the rate of 6d. per share, free of tax, £117,865; carried forward, £448,951.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Monopole Metal Company, Limited, 13, Finsbury Square, London, E.C.2.—Capital £100.

Iron Paving, Limited.—Capital £50,000. To develop the Tri Pedal Unit System of road-surfacing. Subscriber: A. E. Isemonger, 199, Piccadilly, W.1.

Contract Open

Johannesburg, July 30.—Metal vacuum-brake parts, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference G.Y. 13,935.)

Obituary

MR. EBENEZER HALL, who died at his home in Sheffield recently, at the age of 84, joined Messrs. Martin, Hall & Company, Limited, Britannia-metal manufacturers, over 60 years ago. For many years he was a director, and then he became managing director, retiring between 10 and 12 years ago. He was a nephew of Mr. Ebenezer Hall, one of the founders of the company.

REFINED COLD BLAST PIG IRON

REFINED PIG FOR MOTOR CYLINDERS .....

CHILLED IRONS FOR CHILLED CASTINGS .....

REFINED HEMATITES FOR MALLEABLE CASTINGS

Castings made from these irons have greater density and toughness. You will have fewer rejections — greater freedom from checks, cracks, breaks and other defects.

Hand Samples on Request —

Telephones:
WALSALL 2131.
BILSTON No. 41069.
Telegrams:
"IRON, BILSTON."

WEST MIDLAND REFINING CO., LTD.,

Registered Office: **Lloyd's Bank Chambers, WALSALL.** *Works:* **Millfields Road, BILSTON.**

---

for 70 YEARS

DURRANS

HAVE SUPPLIED THE FINEST

BLACKING

PLUMBAGO AND ALL FACINGS

NO FINER BLACKING IS USED IN ANY FOUNDRY.....

JAMES DURRANS & SONS, LTD.

PENISTONE NEAR SHEFFIELD.

TELEPHONE - 21 PENISTONE. TELEGRAMS - "BLACKING, PENISTONE"

Raw Material Markets

Business remains quiet in the iron and steel trade, but it is generally held that this is nothing more than the customary seasonal slowing down, and that no falling away in consumption is involved. The foundry industry is fairly well employed, the light-castings section, as before, being the most active.

Pig-Iron

MIDDLESBROUGH.—The market in Cleveland foundry iron is firm. Although new business is somewhat slow in coming along, the current output of iron is well taken up, and the continued activity in the consuming trades augurs well for the future. There is no hint of any price changes. Foreign sales can be negotiated without reference to the minimum-price scale, but this applies to all home sales, No. 3 Cleveland G.M.B. being 67s. 6d. per ton for local delivery, 69s. 6d. for the North-East Coast, 67s. 3d. delivered Falkirk and 70s. 3d. delivered Glasgow. One shilling per ton less than the foregoing prices is charged for No. 4 foundry and No. 4 forge, whilst No. 1 foundry iron is 2s. 6d. per ton more than No. 3.

Although no weakness is yet apparent in the East Coast hematite market, the position is causing some anxiety, inasmuch as new business is developing very slowly, and there is a very large output to be disposed of. It is thought, however, that business will revive with the turn of the half-year. Home sales are still determined on the basis of 68s. per ton for No. 1 hematite delivered Middlesbrough area. For delivery elsewhere, the principal quotations are as follow:—North-East Coast, 70s.; Yorkshire, 74s. to 77s.; Lancashire, 76s.; Scotland, 75s.; Birmingham, 79s. per ton.

LANCASHIRE.—The demand for pig-iron from this area remains quiet, but should broaden out within the next few weeks. Deliveries against existing contracts continue to make a satisfactory showing. Prices of pig-iron are well maintained, current offers of Staffordshire, Derbyshire and Cleveland brands of No. 3 foundry for delivery to works in the Lancashire zone being on the basis of 74s. per ton, with Northamptonshire at 72s. 6d. Indian iron is quoted in the region of 76s. for delivery to users in this area, and sales of Scottish brands, which are quoted at 6s. or 7s. more, are restricted in consequence.

MIDLANDS.—Although many contracts for the supply of foundry iron expire at the end of this month, business has so far been distinctly hanging fire. This is somewhat surprising, as most of the foundries have plenty of work on hand, and there seems to be no possibility of securing lower prices by waiting. Current quotations for Midland brands of pig-iron delivered Birmingham and Black Country stations are 67s. 6d. per ton for Northants No. 3, and 71s. for Derbyshire, Staffordshire and Lincolnshire No. 3, less a small rebate for large consumers. In connection with pig-iron of a special nature for engineering work, prices are firmly held and gradual expansion is being felt. Scottish No. 3 low-phosphorus iron is 85s. to 87s. 6d., with other irons of similar analysis from 81s. to 85s. Medium-phosphorus pig-iron is offered at from 70s. to 80s. and special refined iron for engine work, etc., at £5 15s. to £6 15s. per ton, according to analysis.

SCOTLAND.—Business on the Glasgow market has slowed down considerably with the approach of the holiday and stock-taking season. Falkirk and district works close down at the end of this week, to be followed by the Glasgow Fair holidays. There has been no change in prices. No. 3 Scottish foundry iron is at 70s. f.o.r. furnaces, with 2s. 6d. per ton extra for No. 1, and Cleveland foundry iron remains at 67s. 3d. f.o.r. Falkirk and 70s. 3d. f.o.r. Glasgow and district.

Coke

There is little change to report in this direction, the market maintaining a firm tone. Considerable booking has been witnessed lately, in some cases over the last quarter of the year. Current quotations for delivery in the South Staffs area are as follow:—Best Durham foundry coke, 36s. 6d. to 40s.; other qualities, 34s. 6d. to 35s.; Scottish, 41s. to 42s.; Welsh, according to analysis, from 37s. 6d. to 45s. per ton.

Steel

Steady but rather quiet conditions have developed in the steel markets, but most of the works are well employed on orders secured early in the year, states the official report of the London Iron and Steel Exchange. Business in the semi-finished steel department has declined, and although the works are producing on a good scale, new business is not coming forward to take the place of completed contracts. Competition from Continental works in this department has become more pronounced, and some fair-sized orders are reported to have been placed abroad. Considerable activity continues to rule in the finished-steel department, but most of the business transacted is with home consumers. There has been some increase in the export demand lately, principally with other parts of the Empire. The heavy side of the industry is well occupied, and specifications against contracts are coming forward satisfactorily, while the demand for the lighter steel products is well maintained.

Scrap

In the Cleveland area a steady trade continues to be done in scrap-iron materials at unchanged prices. Similar conditions prevail as regards the Midlands, where heavy machinery metal is quoted at 55s., good heavy pipe and plate at 50s. and clean light at 47s. 6d., all delivered works. There is a fair demand in South Wales for both heavy and light cast-iron scrap, at 47s. 6d. to 48s. 6d. and 42s. to 44s. per ton respectively, but good cast-iron machinery scrap has a very restricted sale at about 50s. to 52s. 6d. In Scotland the lack of demand from the foundries makes it difficult to sell even odd lots of machinery cast iron, which is quoted at 55s. to 56s. 3d., ordinary cast iron being at 51s. to 52s. 6d.

Metals

Copper.—The London copper market has evinced a weak tone recently, plentiful supplies being pressed for sale. It is stated that world stocks of refined copper showed a considerable decline during May, and are now equal to about four months' consumption, but these statistics only cover stocks in producers' hands, and it is believed that a considerable amount of copper is held elsewhere.

Daily quotations:—

Cash.—Thursday, £32 to £32 1s. 3d.; Friday, £31 12s. 6d. to £31 13s. 9d.; Monday, £31 12s. 6d. to £31 15s.; Tuesday, £31 10s. to £31 12s. 6d.; Wednesday, £31 8s. 9d. to £31 10s.

Three Months.—Thursday, £32 6s. 3d. to £32 7s. 6d.; Friday, £32 to £32 2s. 6d.; Monday, £32 to £32 1s. 3d.; Tuesday, £31 18s. 9d. to £32; Wednesday, £31 17s. 6d. to £31 18s. 9d.

Tin.—With further arrivals of Dutch tin in Liverpool, a small contango has been established, but latterly, with the near position supported, there is already a tendency for the contango to disappear. Trade demand in this country and on the Continent is dull and business with consumers in the United States of America is reported very quiet. The firmness obtaining must therefore be ascribed to the influential support which the market has enjoyed and which has been consistently afforded, for no other feature has arisen which would account for any advance in prices; on the contrary, some weakness might have been expected following the continued slackness in trade demand, further to which metal has been offered in the U.S.A. very freely at relatively low prices, whilst the outlook for the tinplate industry in that country is not too reassuring, report Messrs. Rudolf Wolff.

Market prices:—

Cash.—Thursday, £225 15s. to £226; Friday, £226 5s. to £226 10s.; Monday, £227 10s. to £227 12s. 6d.; Tuesday, £226 12s. 6d. to £226 17s. 6d.; Wednesday, £225 7s. 6d. to £225 10s.

Three Months.—Thursday, £226 to £226 2s. 6d.; Friday, £226 7s. 6d. to £226 10s.; Monday, £227 10s. to £227 12s. 6d.; Tuesday, £226 7s. 6d. to £226 10s.; Wednesday, £225 to £225 2s. 6d.

Spelter.—Following recent heavy arrivals of Mexican spelter in this country, the market has had a depressed tone, and quotations fell on Monday to the lowest level reached this year (*i.e.*, £13 11s. 3d. per ton, as compared with 1933's lowest level of £13 10s.). A slack demand from consumers in this country has not helped the situation.

Day-by-day prices:—

Ordinary.—Thursday, £13 18s. 9d.; Friday, £13 13s. 9d.; Monday, £13 11s. 3d.; Tuesday, £13 12s. 6d.; Wednesday, £13 12s. 6d.

Lead.—Quotations keep steady, and the outlook in this market is fairly good. Lead pipes and sheets have remained in good demand in this country, and there are one or two indications of an improvement in the call for heavy cables.

Market fluctuations:—

Soft Foreign (Prompt).—Thursday, £11; Friday, £11; Monday, £11; Tuesday, £11 2s. 6d.; Wednesday, £11 2s. 6d.

Iron and Steel as the Basis of Industry

ADDRESS BY SIR WILLIAM J. LARKE, K.B.E.

In the course of an address on "Iron and Steel as the Basis of Industry" to the monthly luncheon meeting of the British Engineers' Association recently in London, Mr. William Reavell (President) in the chair, Sir William J. Larke, K.B.E. (Director of the British Iron and Steel Federation), remarked that although protection for the iron and steel industry was introduced in October, 1931, and raised to the present rate in April, 1932, the duties did not become really effective till January, 1933, due to Continental manufacturers forestalling them by a large increase in exports to this country during the latter part of 1931. In November and December of that year, imports were at the rate of over 4 million tons per annum. In 1931 steel production was only 5.2 million tons compared with 9.6 millions in 1929. During 1933, representing a full year of protection, steel output increased to 7 million tons, or practically 40 per cent. over the previous year. There was an increase of 2 million tons in consumption due to growth in demand, which was progressively increasing, and for the present year to date steel output had been at the rate of upwards of 9 million tons per annum. This improvement had been reflected in employment in the iron and steel industry; thus in January, 1933, some 44 per cent. of the insured workers were unemployed, but to-day the figure had fallen to just over 25 per cent. of the insured workers.

Referring to foreign trade in iron and steel, Sir William pointed out that imports, which had fallen to 63,000 tons in July last year, had been steadily increasing and were now about 125,000 tons per month, due probably to efforts of the Continental steel makers to maintain their position in our home market with a view to its bearing upon future discussions which might take place with British steel manufacturers regarding participation in the Cartel. On the other hand, the rate of total exports was increasing, being some 14 per cent. higher to date for the present year than for the corresponding period of last year.

On the question of iron and steel prices, Sir William showed that, according to the Board of Trade price index, these were 9.4 per cent. above 1913; compared with April, 1933, however, the advance was under 5 per cent. and was actually 5 per cent. lower than the average price for 1929, despite a substantial increase in the price of raw materials.

Thermal Conductivity of Irons and Steels

The United States Bureau of Standards has determined the thermal conductivities of 20 miscellaneous irons and steels over the temperature range 100 to 500 deg. C. (212 to 932 deg. Fah.). The materials were selected as typical examples of commercial materials used for a variety of purposes and were expected to differ considerably in thermal conductivities. They included cast irons, carbon and low-alloy steels, high chromium and manganese alloy steels, and "18-8" type of stainless steel. The results, which are published in the "Journal of Research of the Bureau of Standards," show that the differences in conductivity of irons and steels are much smaller at high temperatures than at room temperatures. High-alloy steels have lower thermal conductivities than low-alloy steels, while an increase in the amount of alloy constituents in iron causes, in general, an increase in the temperature coefficient of thermal conductivity.

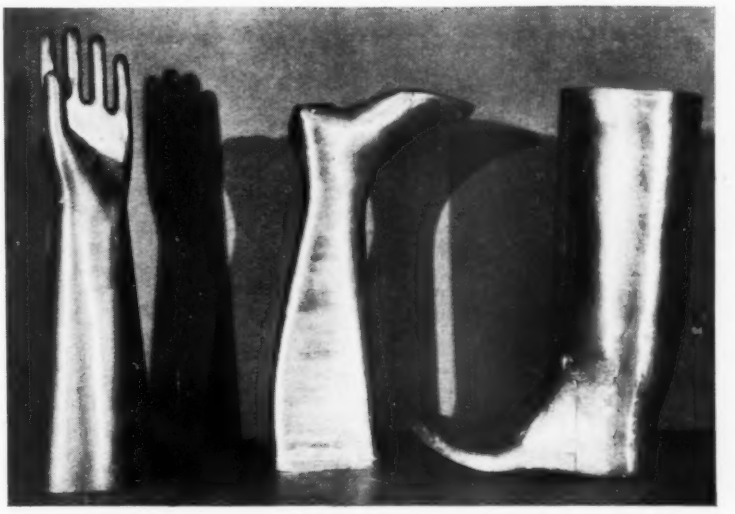
XUM

for

LIGHT WEIGHT
GOOD SURFACE
RESISTANCE

to sulphur fumes

The need for an unblemished surface in a rubber glove, Wellington or a gaiter is a call for aluminium, and the extent to which the rubber industry employs aluminium for these productions is evidence of the suitability of the metal for castings which must be of a good surface, light in weight and resistant to sulphur fumes. The forms illustrated here were cast in aluminium alloy by Messrs. William Mills, Ltd.



BA **ALUMINIUM AND LIGHT ALLOYS**
The BRITISH ALUMINIUM CO. *Ltd.*

HEAD OFFICE: ADELAIDE HOUSE, KING WILLIAM ST., LONDON, E.C.4.
TELEPHONE MANSION HOUSE 5561 & 8074 (5 LINES) TELEGRAMS: CRYOLITE, BILGATE, LONDON

LONDON WAREHOUSE: 25-29, Pancras Rd., N.W.1. BIRMINGHAM: 2, Lawley St. MANCHESTER: 274, Deansgate. LEEDS: 66, Kirkstall Rd. NEWCASTLE-ON-TYNE: Milburn House. GLASGOW: 113, West Regent St.

The BRITISH ALUMINIUM COMPANY *Ltd.*

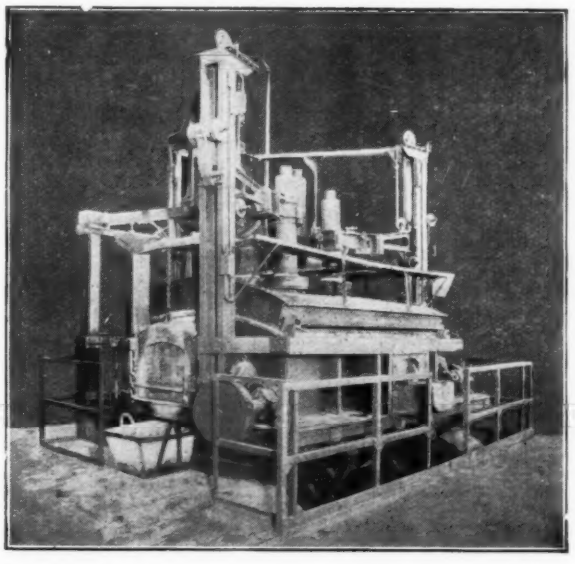
F.T.J. 28.6.34.

GREAVES-ETCHELLS ELECTRIC STEEL FURNACES

MORE THAN 100 FURNACES SUPPLIED DURING LAST 7 YEARS.

WATSON ROTATING ELECTRIC FURNACES Ensure RAPID & CLEAN MELTING

THOROUGH MIXING.



NON-FERROUS METAL MELTING ELECTRIC FURNACES

SINGLE, TWO, or THREE PHASE.

CONTRACTORS TO HOME AND FOREIGN GOVERNMENTS.

WATSONS (METALLURGISTS) LIMITED

Adelaide Works, Mowbray Street, SHEFFIELD, 3.

RAW MATERIALS—PRICE LIST

(Wednesday, June 27, 1934)

COPPER

	£	s.	d.
Standard cash	31	8	9
Three months	31	17	6
Electrolytic	34	15	0
Tough	33	10	0
Best selected	34	0	0
Sheets	62	0	0
India	44	0	0
Wire bars	35	2	6
Ingot bars	35	2	6
H.C. wire rods	37	12	6
Off. av. cash, May	32	14	0 9/32
Do., 3 mths., May	32	19	2 5/16
Do., Sttlmnt., May	32	13	11 5/16
Do., Electro, May	35	19	2 5/16
Do., B.S., May	35	16	11 1/8
Do., wire bars, May	36	3	3 5/16
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6½d.

BRASS

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7½d.
Wire	7¾d.
Rolled metal	7d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£	s.	d.
Standard cash	225	7	6
Three months	225	0	0
English	226	5	0
Bars	227	5	0
Straits (nom.)	226	0	0
Australian (nom.)			—
Eastern	226	0	0
Banca (nom.)			—
Off. av. cash, May	234	7	8 1/32
Do., 3 mths., May	231	1	6 9/16
Do., Sttlmt., May	234	7	6

SPELTER

	£	s.	d.
Ordinary	13	12	6
Remelted	14	2	6
Hard	11	2	6
Electro 99.9	16	5	0
English	14	5	0
India	13	2	6
Zinc dust	16	15	0
Zinc ashes	3	2	6
Off. aver., May	14	16	10½
Aver. spot, May	14	14	5 7/16

LEAD

	£	s.	d.
Soft foreign ppt.	11	2	6
Empire (nom.)	11	12	6
English	12	15	0
Off. average, May	11	3	11 1/32
Average spot, May	11	1	0 5/16

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	5	0
Do., V.M. ex whse.	22	2	6
Rods	28	0	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	40	0	0	to 43	0	0	
Chinese, ex-whse.				32	0	0	
Crude				24	10	0	

QUICKSILVER

Quicksilver	11	2	6	to 11	10	0	

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—			
25%	8	17	6
45/50%	13	0	0
75%	18	7	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free of Mo.	5/6 per lb.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£14	10	0
Ferro-tungsten—			
80/85%	3/3 lb.		
Tungsten metal powder—			
98/99%	3/6 lb.		
Ferro-chrome—			
2/4% car.	29	15	0
4/6% car.	23	0	0
6/8% car.	21	12	6
8/10% car.	21	12	6
Ferro-chrome—			
Max. 2% car.	36	0	0
Max. 1% car.	38	15	0
Max. 0.70% car.	42	0	0
70% carbon-free	10d. lb.		
Nickel—99.5/100%	£200 to £205		
"F" nickel shot	£180	0	0
Ferro-cobalt, 98/99%	5/3 lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11 5 0		
76/80% packed	£11 15 0 to £12 5 0		
76/80% export (nom.)	£9 15 0		
Metallic manganese—			
94/96% carbon-free	1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/8 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel					2	15	0
Bundled steel and shrngs.					2	7	6
Mixed iron and steel					2	10	0
Heavy cast iron	2	7	6	to 2	8	6	
Good machinery	2	10	0	to 2	12	6	
Cleveland—							
Heavy steel	2	10	0	to 2	12	6	
Steel turnings				1	17	6	
Cast-iron borings				1	7	6	
Heavy forge				2	10	0	
W.I. piling scrap				2	5	0	
Cast-iron scrap	2	12	6	to 2	15	0	
Midlands—							
Light cast-iron scrap				2	7	6	
Heavy wrought iron				3	0	0	
Steel turnings, f.o.r.				1	13	0	
Scotland—							
Heavy steel				2	10	0	
Ordinary cast iron	2	11	0	to 2	12	6	
Engineers' turnings	1	19	0	to 2	0	0	
Cast-iron borings	1	18	6	to 2	0	0	
Wrought-iron piling	2	10	0	to 2	11	3	
Heavy machinery				2	15	0	

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	26	0	0
Brass	19	0	0
Lead (less usual draft)	10	0	0
Tea lead	7	5	0
Zinc	9	10	0
New aluminium cuttings	69	0	0
Braziery copper	23	0	0
Gunmetal	24	10	0
Hollow pewter	150	0	0
Shaped black pewter	110	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	68/-
Hematite M/Nos.	67/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	80/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0	
Nut and bolt iron	7	10	0	to 8	0	0	
Hoops			10	10	0	and up.	
Marked bars (Staffs) f.o.t.			12	0	0		
Gas strip			10	10	0	and up.	
Bolts and nuts, ¾ in. × 4 in.			14	0	0		
Steel—							
Plates, ship, etc.	8	15	0	to 8	17	6	
Boiler plts.	8	2	6	to 8	10	0	
Chequer plts.			10	7	6		
Angles			8	7	6		
Tees			9	7	6		
Joists			8	15	0		
Rounds and squares, 3 in. to 5½ in.			9	7	6		
Rounds under 3 in. to ¼ in. (Untested)			8	12	0		
Flats—8 in. wide and over			8	12	6		
,, under 8 in. and over 5 in.			8	17	6		
Rails, heavy	8	5	0	to 8	10	0	
Fishplates	12	5	0	to 12	10	0	
Hoops (Staffs)			9	7	0		
Black sheets, 24g. (4-t. lots)			10	10	0		
Galv. cor. shts. (,,)			13	0	0		
Galv. flat shts. (,,)			13	10	0		
Galv. fencing wire, 8g. plain			14	10	0		
Billets, soft			5	10	0		
Billets, hard	6	17	6	to 7	2	6	
Sheet bars	5	0	0	to 5	5	0	
Tin bars			5	0	0		

PHOSPHOR BRONZE

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	12d.
Rods	11d.
Tubes	15d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	17.50
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	29.00
Sheet bars	30.00
Wire rods	38.00
	Cents.
Iron bars, Phila.	1.94
Steel bars	1.90
Tank plates	1.85
Beams, etc.	1.85
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.65
Sheets, galv., No. 24	3.25
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	20/-
Durham foundry	21/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	17/3 to 17/6
,,	28×20 ,,	34/6 to 35/-
,,	20×10 ,,	24/9 to 25/-
,,	18¾×14 ,,	18/- to 18/1½
C.W.	20×14 ,,	15/6
,,	28×20 ,,	32/6
,,	20×10 ,,	22/-
,,	18¾×14 ,,	15/6

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6	0	0	to £7	0	0	
Bars-hammered, basis	£16	0	0	to £16	10	0	
Bars and nail-rods, rolled, basis	£15	15	0	to £16	0	0	
Blooms	£10	0	0	to £12	0	0	
Keg steel	£30	0	0	to £31	0	0	
Faggot steel	£18	0	0	to £23	0	0	
Bars and rods dead soft, st'l	£10	0	0	to £12	0	0	

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.		
June	21 ..	32	0	0	dec.	1/3
„	22 ..	31	12	6	„	7/6
„	25 ..	31	12	6	No change	
„	26 ..	31	10	0	dec.	10/-
„	27 ..	31	8	9	„	1/3

Electrolytic Copper

		£	s.	d.		
June	21 ..	35	5	0	No change	
„	22 ..	34	15	0	dec.	10/-
„	25 ..	34	15	0	No change	
„	26 ..	34	15	0	„	„
„	27 ..	34	15	0	„	„

Standard Tin (cash)

		£	s.	d.		
June	21 ..	225	15	0	dec.	7/6
„	22 ..	226	5	0	inc.	10/-
„	25 ..	227	10	0	„	25/-
„	26 ..	226	12	6	dec.	17/6
„	27 ..	225	7	6	„	25/-

Tin (English ingots)

		£	s.	d.		
June	21 ..	226	10	0	dec.	7/6
„	22 ..	227	0	0	inc.	10/-
„	25 ..	228	5	0	„	25/-
„	26 ..	227	10	0	dec.	15/-
„	27 ..	226	5	0	„	25/-

Spelter (ordinary)

		£	s.	d.		
June	21 ..	13	18	9	dec.	1/3
„	22 ..	13	13	9	„	5/-
„	25 ..	13	11	3	„	2/6
„	26 ..	13	12	6	inc.	1/3
„	27 ..	13	12	6	No change	

Spelter (Electro, 99.9 per cent.)

		£	s.	d.		
June	21 ..	16	11	3	dec.	1/3
„	22 ..	16	6	3	„	5/-
„	25 ..	16	3	9	„	2/6
„	26 ..	16	5	0	inc.	1/3
„	27 ..	16	5	0	No change	

Zinc Sheets (English)

		£	s.	d.		
June	21 ..	23	5	0	No change	
„	22 ..	23	5	0	„	„
„	25 ..	23	5	0	„	„
„	26 ..	23	5	0	„	„
„	27 ..	23	5	0	„	„

Lead (English)

		£	s.	d.		
June	21 ..	12	15	0	No change	
„	22 ..	12	15	0	„	„
„	25 ..	12	15	0	„	„
„	26 ..	12	15	0	„	„
„	27 ..	12	15	0	„	„

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 4 0	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1931	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1932	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1933	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1934	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOUNDRY Foreman desires improved position; thoroughly experienced in the economical production of high-class steel, heat- and wear-resisting cast irons, and non-ferrous castings, in electric, oil-fired and coke furnaces; able to take full control. Excellent credentials. —Box 798, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Manager (non-ferrous) open to re-engagement; thoroughly qualified and can show excellent results, all kinds of alloys, etc.—Apply, Box 786, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

VACANCY for Man in small non-ferrous foundry, one able to invest £150 to £200.—Write age, experience, etc., to C. R. DODD, 2 and 3, Hind Court, London, E.C.4.

WANTED, Working Foreman with knowledge of patterns for finishing and fitting shop of firm manufacturing light castings, stoves and grates. Manchester district. Shop run on partnership scheme. Guaranteed wage and proportion of profits. No capital required for investment. Age 35-50.—Reply, stating experience and length of service with each firm, also position now occupied, to Box 794, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATENT

THE Proprietors of the Patent No. 226,751, for "Improvements in or relating to Processes for Incorporating Manganese with Iron," are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to Haseltine, Lake & Company, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

FOR SALE BY PRIVATE TREATY

By Direction of TRIPLEX FOUNDRY, LIMITED, GREAT BRIDGE, STAFFS, who are shortly removing to their New Foundry at Tipton.

FOR SALE BY PRIVATE TREATY, WITH POSSESSION ON COMPLETION,

The Substantially-built and Extensive FREEHOLD MANUFACTURING PREMISES,

Situate at Bridge Road and Toll End Road, GREAT BRIDGE, TIPTON, STAFFS,

COMPRISING A TOTAL AREA OF 20,900 SQUARE YARDS

with RUNWAYS and FIRST-CLASS MELTING PLANT.

There is a frontage to Canal Basin of about 1,000 ft. The distance from the L.M. & S. and G.W.R. Goods Stations at Great Bridge is ¼-mile, and services include South Staffs and Canal Water Supplies, Gas and Electric Light and Power.

First-class South Staffordshire labour is available in the district.

Further particulars and Permits to Inspect may be obtained from J. V. BOSWELL & COMPANY, F.A.I., Auctioneers and Valuers, 4, Waterloo Road, Wolverhampton (Telephone 21216/7), or MESSRS. CHESSHIRE, GIBSON & COMPANY, F.A.I., Auctioneers and Valuers, 21, Waterloo Street, Birmingham (Telephone Midland 6651/2).

PROPERTY

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,

ALBION WORKS, SHEFFIELD

MACHINERY

FURNACE Required, New or Secondhand, to melt special iron mixtures half or ton charges.—Box 788, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, a Modern-type SAND MILL. State capacity and price.—Box 792, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

SAND-BLAST PLANTS AND AIR COMPRESSORS

(Tilghman's).

We have in stock :—

11 NEW SAND-BLAST PLANTS.
14 Re-conditioned Sand-blast Plants.
90 NEW AIR COMPRESSORS.
15 Re-conditioned Air Compressors.
All sizes—all pressures.

Sand-blasting and Metal-spraying for all Trades.

R. J. RICHARDSON & SONS, LTD.,
COMMERCIAL STREET, BIRMINGHAM, 1.

THOS. W. WARD LTD.

Vert. Treble Ram PUMP, 7" dia. rams, 9" str., 10,000 gals.

Set of CROPPING SHEARS (Pels), joists 15" x 5".

New Pneu. SAND MOULDER, admits boxes 16" x 16" x 6".

5 NISSEN TYPE STEEL BUILDINGS, 550' x 40' x 19' 10" high.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

SANDBLAST PLANTS

Room, Rotary Barrel and Cabinet Types complete; 12 in stock.

SAND PLANT

Sand Mills, 6-ft., 5-ft. and 4-ft. 6-in. dia. Pans.

Rotoil "Senior" Oil Core Sand Mixer.

Pneulec Sand Drying Plant, output 1 ton per hour.

Brearley Type Disintegrators.

MOULDING MACHINES

Hand and Pneumatic Types.

Also

Six Rowlands Double-ended Grinders for 24-in. dia. x 2-in. wheels.

Electrical and Belt-driven Blowers and Exhaust Fans, Ladles, etc., etc.

AIR COMPRESSORS

All sizes for high and low pressures.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.
'Phone: Broadwell 1359.

MACHINERY—*Continued*

FOR SALE ON BEHALF OF HENRY FORD & SON, LIMITED, CORK.

TWO No. 4B LOW-SPEED ROOTS BLOWERS. Type No. H.1040, arranged for top discharge and belt drive. Capacity 4,600 cub. ft. of free air per min. to 5 lbs. pressure at 320 r.p.m. Date 1929.

FOUR No. 6 LOW-SPEED ROOTS BLOWERS, arranged for direct coupling and gear reduction, top discharge, 8,680 cub. ft. of free air per min. to 1½ lbs. pressure at 310 r.p.m. Date 1930.

TWO THWAITE BROS. No. 6 LOW-SPEED ROOTS-TYPE BLOWERS, arranged for direct coupling with gear reduction. Top discharge, capacity 8,680 cub. ft. free air per min. to 1½ lbs. pressure at 310 r.p.m

The above equipment is in excellent condition and can be viewed at the works of the Ford Motor Company, Limited, Dagenham, Essex.—Write, Box 796, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS

FLUIDITY TESTS as described in THE FOUNDRY TRADE JOURNAL, February 1, 1934. Patterns of the above in aluminium can be supplied for 35s. per set. Post free. We can also supply Patterns for all branches of the engineering trade, in hard or soft woods. Send us your inquiries.—FURMSTON & LAWLOR, Patternmakers, Letchworth, Herts.

CORE BOXES, dowelled and varnished, ready for use, made to order in all lengths and variety on shortest notice. HARDWOOD MALLETS also a speciality.—WILLIAM OLSEN, LIMITED, Cogan Street, Hull.

'Phone: 287 SLOUGH

SANDBLAST PLANTS

12' × 9' Tilghman sandblast room, built of cast iron plates, complete with 400 cu. ft. Tilghman air compressor and all accessories **£290 Nett.**

T.B. 1 Tilghman sandblast barrel plant, complete. CHEAP.

T.B. 3 Tilghman sandblast barrel plant, double-jet, complete. CHEAP.

6' "Jackman" rotary sandblast table. CHEAP seen working.

SAND PLANT

Herbert "Whizzer" type disintegrator, No. 1 **£30**
Pneumatic riddle, by Macdonald **£8**
Large "Baillott" sand preparing plant CHEAP.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

RYLAND'S DIRECTORY

[2,200 pages 8½" × 5½"].

The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades.

1934 EDITION.

Price 42/- cloth bound, 52/- Morocco.

INDUSTRIAL NEWSPAPERS, Ltd.
49, Wellington St., Strand, London, W.C.2.
Telephone: Temple Bar 3951 (5 lines).

THE "BRITISH HERRMANN"

MOULD DRYING SYSTEM

Burns waste coke.

Maintains even drying temperature.

Ensures perfectly dried mould.

Eliminates night stoking.

Reduces drying time.

Increases output.

READILY ADAPTABLE TO ANY EXISTING STOVE AT LOW COST.

Messrs. Mirrlees Watson Company Ltd., of Glasgow, who specialise in Castings for Sugar Machinery, Centrifugal Pumps and Steam Turbines, have installed the "British Herrmann" System and confirmed its economical performance.

SATISFIED USERS.

Messrs. KRYN & LAHY Ltd., Steel Founders, Letchworth.	Five Elements.
Messrs. C. AKRILL & Co., Ltd., Roll Makers, West Bromwich.	Two Elements.
THE GLANMOR FOUNDRY Co., Ltd., Roll Makers, Llanelly.	Three Elements.
Messrs. CAMERON & ROBERTON, Ltd., General Engineers, Kirkintilloch.	One Element.*
** Further Element on Order.*	
Messrs. H. H. MARTYN & Co., Ltd., Art Metal Founders, Cheltenham.	One Element.
LINOTYPE & MACHINERY Ltd., Printers' Engineers, Altrincham.	Three Elements.
Messrs. JOHN SUMMERS & SONS, Ltd., Steel Makers, Shotton.	Four Elements.

THOMAS E. GRAY & CO., LTD.

The Makers of "SILACENE"

119, HIGH HOLBORN, LONDON, W.C.1

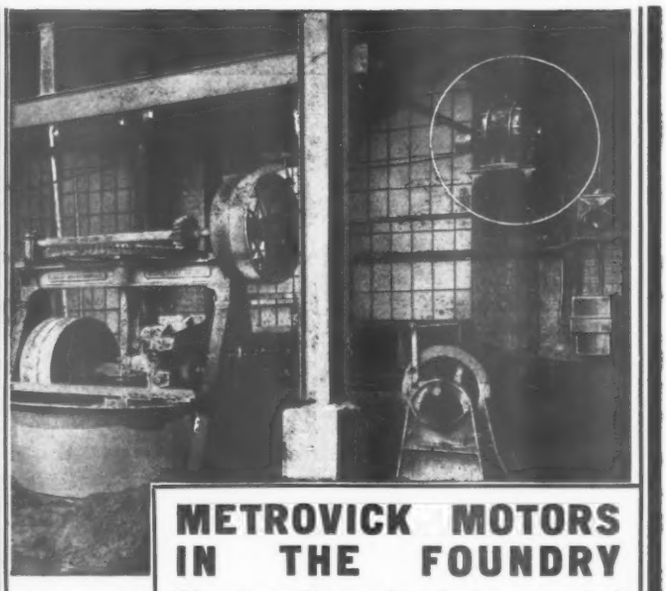
ESTABLISHED 1877

B 2

STANTON

Pig Iron

The Stanton Ironworks Company Limited Near Nottingham



J
A248

METROVICK MOTORS IN THE FOUNDRY

The above illustration depicts a typical example of a 'Metrovick' Motor engaged in Foundry work. The motor is shewn driving two sand mixers and a 7' 6" mill.

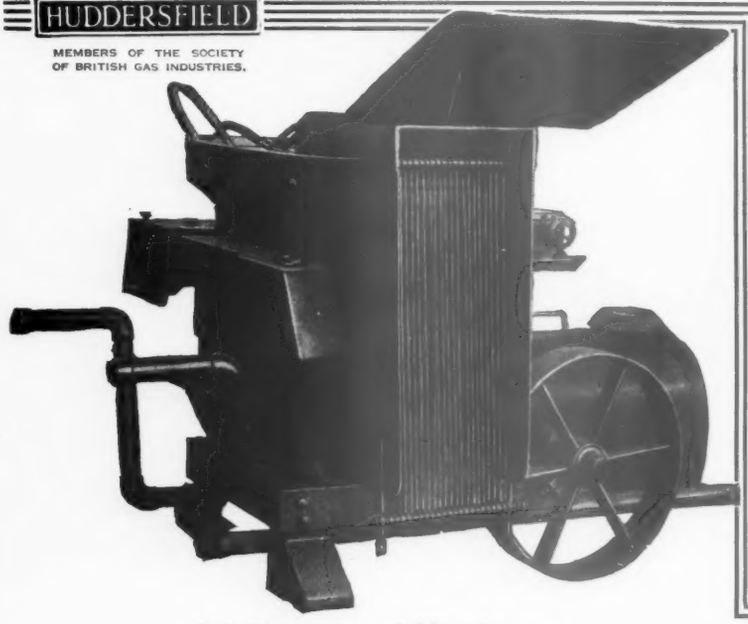
Specify "Metrovick" Motors for your Foundry work.

METROPOLITAN Vickers ELECTRICAL CO., LTD.
SUBSIDIARY OF ASSOCIATED ELECTRICAL INDUSTRIES LTD.
TRAFFORD PARK, MANCHESTER, 17.

HOLMES FOUNDED 1850 HUDDERSFIELD
MEMBERS OF THE SOCIETY OF BRITISH GAS INDUSTRIES.

NEW LABOUR-SAVING MACHINE

for the foundry . . .



Reduce your waster castings by correctly conditioning your sand with a Holmes

V·S·K SAND MIXER

LOW:
- INITIAL COST
- POWER CONSUMPTION
- MAINTENANCE CHARGES

Made in two sizes 5 and 8 tons capacity.

We shall be pleased to demonstrate a machine in operation in our foundry.

Sole Licensees and Manufacturers:

★ ILLUSTRATED BROCHURE ON REQUEST

W. C. HOLMES & CO., LTD.,

Phone: HUDDERSFIELD 1573. (Private Branch Exch.)

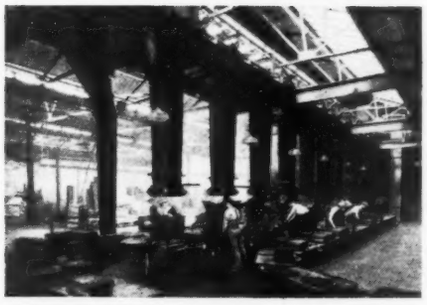
HUDDERSFIELD

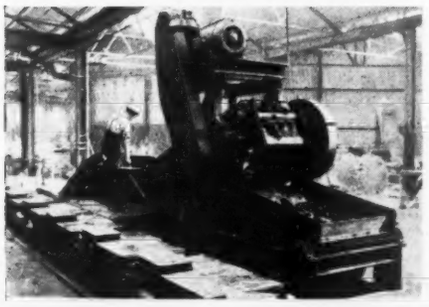
Grams: HOLMES HUDDERSFIELD

London Office: 119, VICTORIA ST., WESTMINSTER, S.W.1. *Phone:* Victoria 7631 (Private Branch Exchange, 2 lines). *Grams:* Ignitor, Sowest, London.

C100a

Mechanization *by* Morris





A newcomer to the foundry trade might imagine that Foundry Mechanization is a new idea.

But old hands remember that, over forty years ago, Morris introduced certain revolutionary changes from hand labour to mechanical handling.

In succeeding years Morris ideas have always been in advance of current practice.

And to-day, for the most efficient all-round system of foundry mechanization, you must still consult a Morris foundry engineer.

Herbert Morris Ltd.
Loughborough England

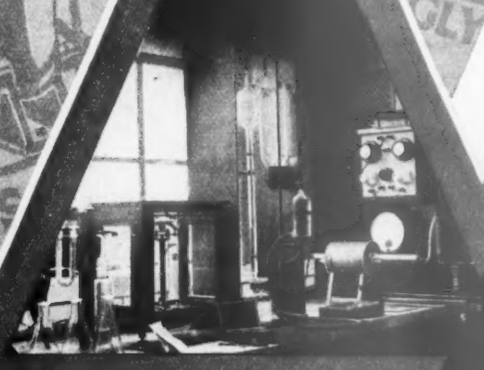
SERVICE with SALES

THERE exists in the Foundries of this Country an ever increasing **demand for help and advice** as to the best methods of turning out the highest class Castings at the lowest cost.

This demand can only be met by a firm with a **Service Department** comprising skilled Founders, Engineers and Chemists, of wide experience and thoroughly practical knowledge.

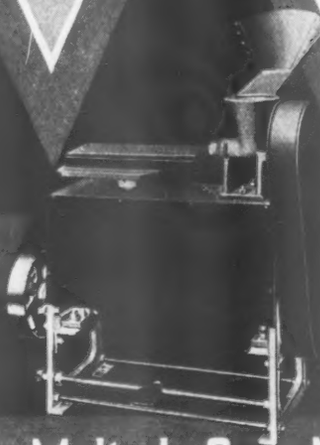
The **Fordath Service Department** fulfils adequately the above demand.

GLYSO CORE OIL COMPOUNDS



GLYSO Laboratories

"ROTOIL" Sand Mixer



New Multiple Core Machine

Our Clients are availing themselves of our "confidential" assistance to an ever increasing extent, and in no case has their confidence been misplaced.

This valuable privilege is yours for the asking, at no cost to yourselves, being an integral part of our policy.

THE FORDATH ENGINEERING Co. LTD

HAMBLET WORKS · WEST BROMWICH · ENGLAND

Telephones: 0549 / 0550 West Bromwich.
Telegrams—"Metallical, Phone," West Bromwich.

Phone : 23001 (10 lines)

THOS. W. WARD LTD.

Grams : "Forward Sheffield"

Head Office: **Albion Works, SHEFFIELD**

For the particular attention of Foundrymen in and around **LONDON**

WE STOCK—

"PRIESTMAN" "CLEVELAND" "SHOTTS"

(DURHAM) FOUNDRY COKE AND GRADED MACHINE CUT COKE NUTS

FOUNDRY PIG IRONS FOR ALL GENERAL FOUNDRY AND LIGHT CASTINGS

SCOTCH PIG IRONS. (THE IRON MADE FROM GENUINE SCOTCH IRONSTONE)

HEMATITES—EAST AND WEST COAST BRANDS

MANSFIELD MOULDING SANDS produced in our own quarry

WE CAN SUPPLY PIG IRONS FROM ALL DISTRICTS, LIMESTONE, ERITH LOAM, GANISTER, Etc., Etc.

ANY QUANTITY—ANY TIME—THE RIGHT PRICE

PHONE OUR WORKS : ALBERT DOCK 2841 (5 lines) **THAMES Rd., SILVERTOWN, E.16**

INDEX TO ADVERTISERS.

	PAGE
Acheson, E. G., Ltd.	—
Aerograph Co., Ltd.	19
Alldays & Onions, Ltd.	17
Allen, Edgar, & Co., Ltd.	—
Allen, T., Fearnley & Son	—
Amalgams Co., Ltd., The	20
Armstrong, Whitworth, Sir W. G., & Co. (Engineers), Ltd.	—
Armstrong, Whitworth, Sir W. G., & Co. (Ironfounders), Ltd.	—
Atlas Preservative Co., Ltd.	—
August's, Ltd.	10
Bagshawe & Co., Ltd.	—
Baker, Perkins, Ltd.	—
Baldwins, Ltd.	18
Barrow Hæmatite Steel Co., Ltd., The	16
Baxter, W. H., Ltd.	—
British Aluminium Co., Ltd.	11
British (Guest Keen Baldwins) Iron & Steel Co., Ltd., The	—
British Oxygen Co., Ltd.	—
British Pigirons, Ltd.	—
British Rema Manufacturing Co., Ltd., The	—
British Reverberatory Furnaces, Ltd.	—
British Thomson-Houston Co., Ltd.	—
Butterworth Bros., Ltd.	20
Carborundum Co., Ltd., The	2
Colvilles, Ltd.	20
Consett Iron Co., Ltd.	22
Crane Chemical (The Fredk.), Co., Ltd.	—
Cumming, Wm., & Co., Ltd.	—
Davidson & Co., Ltd.	—
Distington Hematite Iron Co., Ltd., The	—
Dudley's Round Oak Works Ltd., Earl of	—
Durrans, J., & Sons, Ltd.	417
Eyre Smelting Co., Ltd., The	—
Findlay, A., & Co., Ltd.	—
Fordath Engineering Co., Ltd.	8
Foundry & Engineering Co. (West Bromwich), Ltd.	—
Foundry Equipment, Ltd.	—
Foundry Plant & Machinery, Ltd.	4
Foundry Services, Ltd.	15
"Four Oaks" Spraying Machine Co., The	—
Fox & Offord, Ltd.	—
Gadd, Thos.	—
General Electric Co., Ltd.	—
General Refractories, Ltd.	1
Gibbons (Dudley), Ltd.	—
Giesserei, Die	—
Gossell & Son, Ltd.	16
Gray, Thos. E., & Co., Ltd.	5
Grayson, J., Lowood, & Co., Ltd.	—
Grazebrook M. & W., Ltd.	—
Green, George, & Co.	—
Hammond, Alex.	14
Harper, John, & Co., Ltd.	—
Harper, Wm., Son & Co. (Willenhall), Ltd.	—
Hawkins, W. T., & Co.	—
Herbert, Alfred, Ltd.	—
Holmes, W. C., & Co., Ltd.	6
Horsehay Co., Ltd., The	—
Imperial Chemical Industries, Ltd.	—
Incandescent Heat Co., Ltd., The	—
Jackman, J. W., & Co., Ltd.	—
Jacks, William, & Co.	13
James, Wm.	—
Keith, James, & Blackman Co., Ltd.	—
King Bros. (Stourbridge), Ltd.	—
Knowles, John, & Co. (Wooden Box), Ltd.	—
Lancashire Steel Corporation, Ltd.	—
Le Personne, L., & Co.	—
Lilleshall Co., Ltd.	—
Longden, G., & Son, Ltd.	15
Lord, E. S., Ltd.	—
Low Moor Iron Co., Ltd., The	—
Lowood, J. Grayson, & Co., Ltd.	—
Lysaght, John, Ltd.	—
Macdonald, John, & Co. (Pneumatic Tools), Ltd.	15
Major, Robinson & Co., Ltd.	18
Metropolitan-Vickers Electrical Co., Ltd.	6
Mond Nickel Co., Ltd., The	—
Morgan Crucible Co., Ltd.	—
Morris, Herbert, Ltd.	7
Mowat's Pioneer Grit Co., Ltd.	—
Neild, G.	16
Norton Grinding Wheel Co., Ltd.	—
Notcutt, Walter P., Ltd.	—
Olsen, Wm., Ltd.	18
Parish, J., & Co.	—
Park Gate Iron & Steel Co.	—
Pearson, E. J. & J., Ltd.	19
Pickford, Holland & Co., Ltd.	20
Pitman, Sir Isaac & Sons, Ltd.	—
Pneulec, Ltd.	—
Portway, C., & Sons	—
Price, J. T., & Co., Ltd.	1
Pulzer, S., & Son, Ltd.	—
Purimachos, Ltd.	1
Quest Products, Ltd.	—
Reavell & Co., Ltd.	15
Ritchie, J. & R., Ltd.	1
Roper, E., & Co.	—
Rotary Furnaces, Ltd.	—
St. George's Engineers Ltd.	—
Sankey, J., & Sons, Ltd.	—
Scottish Tar Distillers, Ltd.	15
Sheepbridge Coal & Iron Co., Ltd.	21
Shotts Iron Co., Ltd., The	19
Smarts Dinas Silica Brick Co., Ltd.	18
Smeeton, John A., Ltd.	—
Smith, Albert, & Co.	15
Smith, Edward, Ltd.	18
Smooth-On Mfg. Co.	—
Sommerfield, H. G., Ltd.	20
Spencer & Halstead, Ltd.	—
Spermolin, Ltd.	3
Stanton Ironworks Co., Ltd., The	6
Staveley Coal & Iron Co., Ltd.	—
Stein & Atkinson, Ltd.	21
Stein, J. G., & Co., Ltd.	—
Sterling Foundry Specialties, Ltd.	1
Stewarts and Lloyds, Ltd.	—
Tallis, E., & Sons	—
Tennent, R. B., Ltd.	18
Tilghman's Air Compressor Co.	—
Tilghman's Patent Sand Blast Co., Ltd.	—
United Steel Companies, Ltd., The	—
Vickers-Armstrong, Ltd.	—
Walker, I. & I.	—
Ward, Thos. W., Ltd.	9 & 14
Waring Bros.	16
Warner & Co., Ltd.	—
Watson's (Metallurgists), Ltd.	11
West Midland Refining Co., Ltd.	417
Wilkinson, Thos., & Co., Ltd.	—
Winnall, G., & Son	—
Workington Iron & Steel Co. (Branch of The United Steel Companies, Ltd.)	—
Zimmermann Machines	—

August's

The name and mark of
"The Specialists in Mechanisation"
whose products
"Set the standard by which foundry plant is judged."

Core Stoves.	*Simpson Mixers.*	*Composite Sand Plants.*
Mould Stoves.	*Bucket Loaders.*	*Magnetic Separators.*
Portable Driers.	*August's Aerators.*	*Moulding Machines.*
Continuous Stoves.	*Sand Screens.*	*Core Blowing Machines.*
Bogie Stoves.	*Elevators and Conveyors.*	*Carburising and Heat Treatment Furnaces.*
Drawer Stoves.	*Continuous Casting Plants.*	

HALIFAX, ***ENGLAND.***

Regular repeat orders from Ironfounders all over the United Kingdom testify to the merits of—

ROSS QUICK DRYING BITUMINOUS

BLACK VARNISH

ABSOLUTELY DRY IN 15 MINUTES

Does not crack or chip off. Used by the leading Ironfounders, Constructional Engineering Firms and Shipbuilders. Gives a fine Glossy Finish. Suitable for painting all classes of Iron- and Steel-work exposed to the weather or noxious fumes and gases.

Special **DIPPING OIL** and **DIPPING TAR** for Soil and rain-water goods

SCOTTISH TAR DISTILLERS LTD.,

LIME WHARF CHEMICAL WORKS, FALKIRK.

Telegrams: "Ross, Falkirk." Telephone: No. 695 Falkirk (3 lines).

GROUND GANISTER FOR EVERY TYPE OF FURNACE.

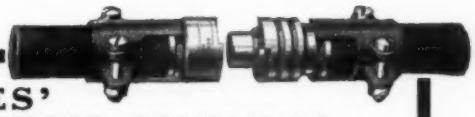
STEEL MOULDERS' COMPOSITION SUITABLE FOR ALL WEIGHTS AND DESCRIPTIONS OF STEEL CASTINGS.

GEORGE LONGDEN & SON, LIMITED,

Parkwood Road Works, Neepsend, SHEFFIELD.

MANUFACTURERS OF HIGH-CLASS REFRACTORY GOODS.

Telegrams: "Longdenson, Sheffield." Telephone No. 25123 (2 lines).



'BOWES'

AIR HOSE COUPLINGS

ABSOLUTELY AIR TIGHT

Instantly Connected or Disconnected

John Macdonald & Co. (Pneumatic Tools) Ltd.,

POLLOKSHAWS, Glasgow.

IRON REGENERATOR

for Purification of Iron & Steel.

REMOVES IRON OXIDE, SLAG INCLUSIONS AND GASES.

IMPROVEMENTS EFFECTED:— CLOSER GRAIN, CLEANER CASTINGS, INCREASED FLUIDITY AND EASIER MACHINING.

FOUNDRY SERVICES, LIMITED,

LONG ACRE, NECHELLS, BIRMINGHAM.

ALBERT SMITH & CO.,

60, St. Enoch Square, GLASGOW, C.1.

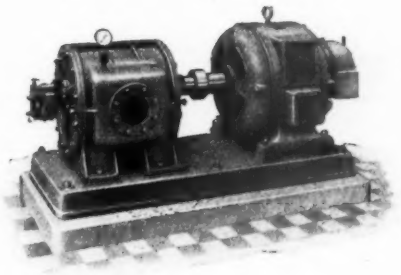
'Phone: Central 5909. 'Grams: Thrower, Glasgow.

FOR COMPLETE FOUNDRY PLANT SERVICE TOOLS FURNISHINGS

EVERYTHING FOR THE FOUNDRY

ROTARY COMPRESSORS

ROLLING DRUM TYPE.



"Reavell" Rotary compressors are made in eleven standard sizes with delivered capacities up to 2,000 cu. ft. free air per minute. They are made as air cooled machines for pressures up to 20 lbs. per sq. in., and are water jacketed for higher pressures.

For particulars of these machines and for other types write to :—Ref. Y.

REAVELL & CO., LTD.,

RANELAGH WORKS, IPSWICH.

Telegrams: "Reavell, Ipswich." 'Phone: 2124 IPSWICH.

XUM

BARROW

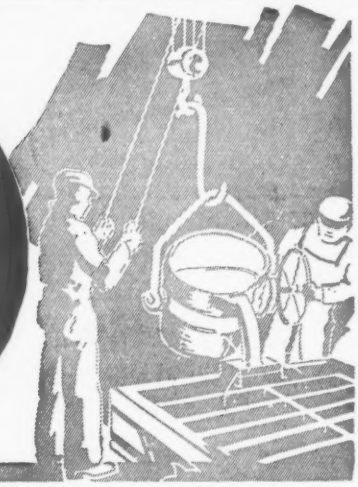
SEMI-PHOSPHORIC PIG IRON

MEETS THE MODERN HIGH TEST REQUIREMENTS OF PRESENT DAY FOUNDRY PRACTICE

WITH MEDIUM PHOSPHORUS CONTENT

ANALYSIS.
Total Carbon 3.50%
Silicon ..... 1.50 to 4.00% as required.
Sulphur ..... .04% maximum.
Phosphorus .10% to .50% in .05% limits.
Manganese ... up to 2.00% as required.

For over 70 years BARROW have been foremost in metallurgical research, hence BARROW Pig Irons have enjoyed ever-increasing popularity and a reputation for quality second to none. This latest development has been specially evolved in response to the demand from iron founders for an iron to ensure FREEDOM FROM POROSITY and extreme toughness. It is now being used in some of the largest foundries with remarkably satisfactory results.



An All-mine Hot-blast Pig Iron which will take a high percentage of scrap in the mixture, it will be found economical in use. Eminently suitable for all castings which are called upon to withstand pressure, e.g., MOTOR CYLINDERS, VALVE BODIES, STEAM and HYDRAULIC CASTINGS, etc.

For your requirements in Hematite and Foundry Pig Irons for all purposes, Refined Open Hearth Cylinder, Heavy Duty and Malleable Irons, apply to:—

THE BARROW HÆMATITE STEEL Co., Ltd.,
BARROW-IN-FURNESS, LANCS.

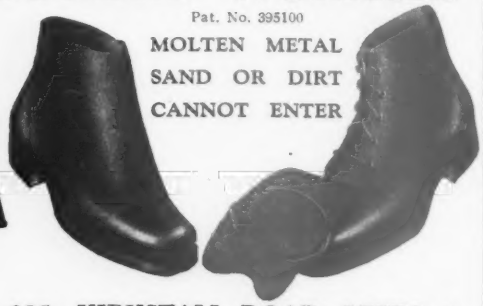
SAFETY FIRST BOOTS *for* FOUNDRY WORKERS

APPROVED BY H.M. FACTORY INSPECTORS

Enquiries invited from Foundry Managers

Pat. No. 395100

MOLTEN METAL
SAND OR DIRT
CANNOT ENTER



G. NEILD, 385, KIRKSTALL ROAD, LEEDS, 4

DEPENDABILITY

IN GREAT OR SMALL

IS

ESSENTIAL.

CHAPLETS are the SMALL things in the FOUNDRY but the BEST are NEEDED.

WARING BROS.

QUALITY IS DEPENDABLE

TEST THEM

Write—DOCK WORKS, BARNSLEY

GOSSELL & SON, LTD.

110, CANNON STREET, LONDON, E.C.4.

Telephone No.:—MANSION HOUSE 6754. Telegraphic Address:—"GOSSOTTO, LONDON."

Specialities—

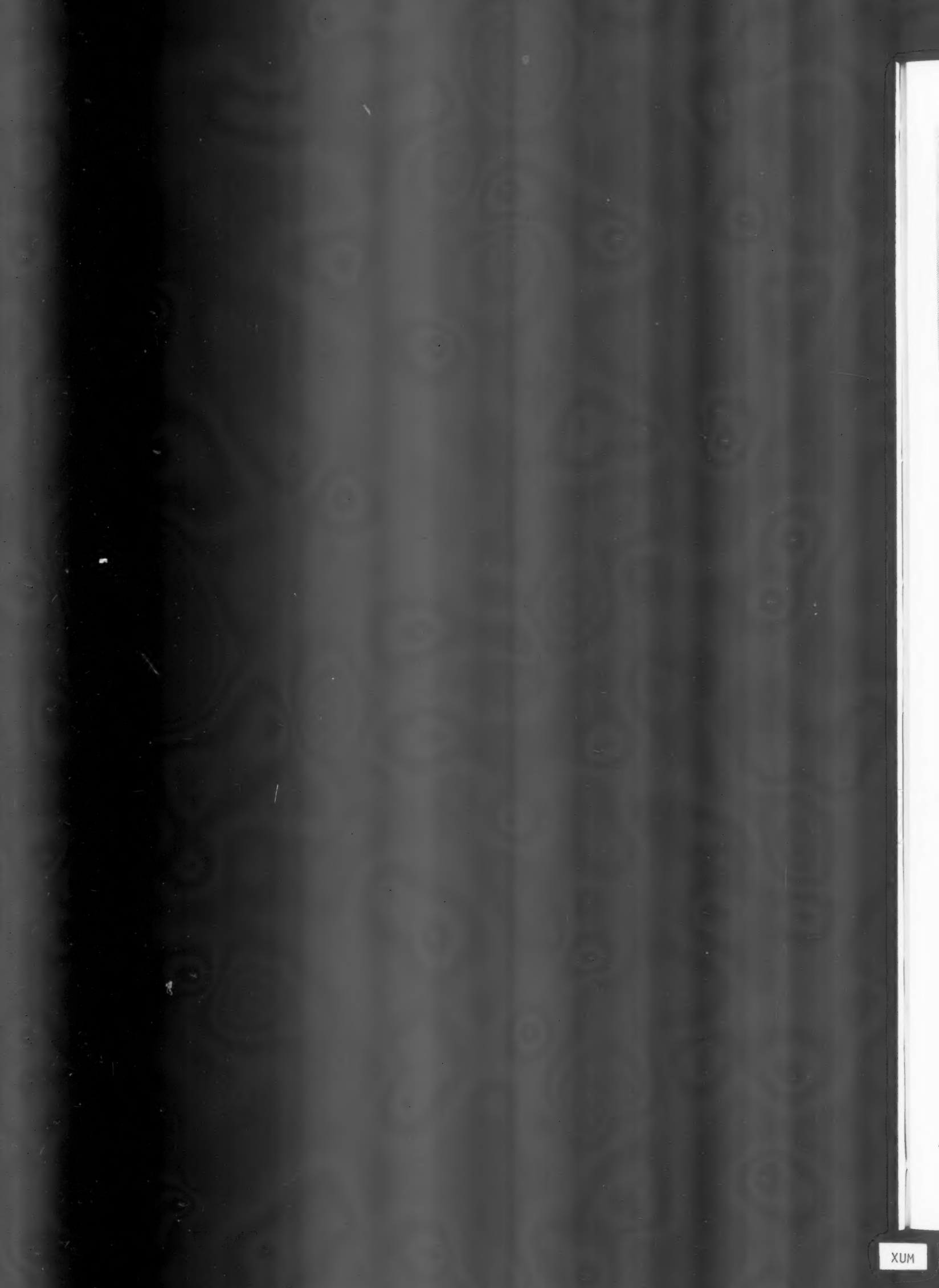
PULVERIZED FUEL INSTALLATIONS for METALLURGICAL FURNACES OF ALL TYPES.

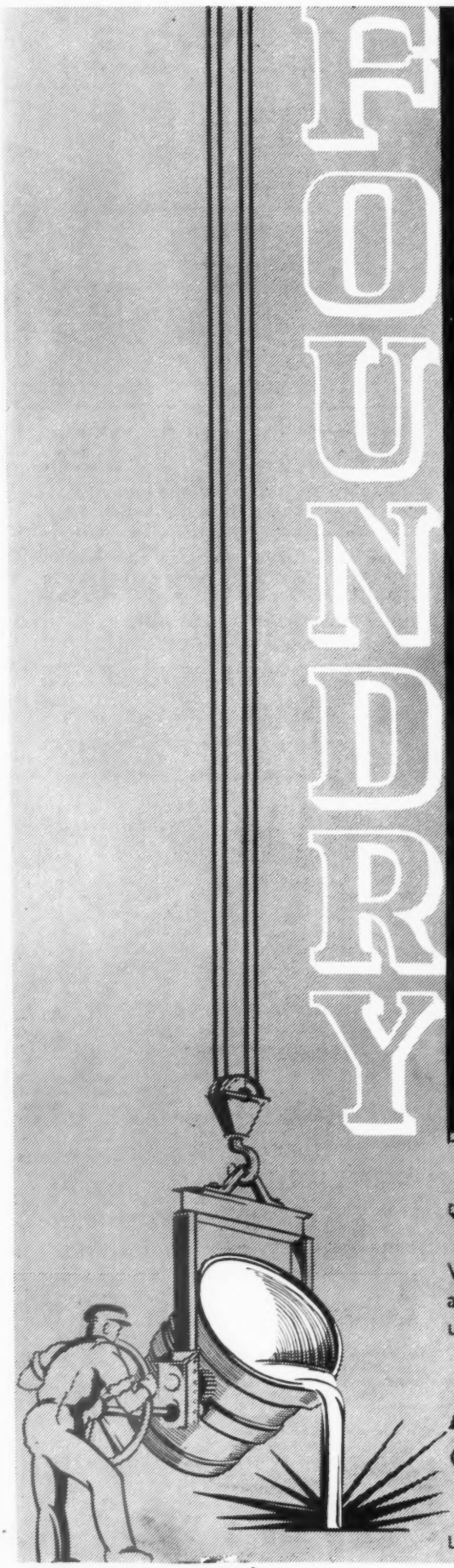
FURNACES, MILLS, BUNKERS, FEEDING APPARATUS, BURNERS, Etc., Etc.

DESIGNS SUPPLIED FOR CONVERSION OF EXISTING FURNACES or for NEW INSTALLATIONS.

OVER 400 FURNACES in SUCCESSFUL OPERATION. TRANSPORT OF PULVERIZED FUEL BY ROAD OR RAIL.

BRIDGEWORK, CONSTRUCTIONAL IRONWORK and LOCOMOTIVES, SPECIAL STEEL CASTINGS, ROLLING STOCK.


XUM



IRON

- HIGH PRESSURE FANS
- ROOTS BLOWERS
- CUPOLAS
- STEEL CONVERTERS
- MOULDING MACHINES
- CHARGING MACHINES
- SAND MILLS
- LADLES

Built for service that the modern foundryman demands .....

EQUIPMENT

We are the actual manufacturers of these specialities and we are therefore in a position to give customers an assurance of undivided responsibility. We also manufacture the balanced blast cupola under licence.

ALLDAYS & ONIONS LTD.

GREAT WESTERN WORKS · SMALL HEATH,

BIRMINGHAM.

LONDON OFFICE:—9, VICTORIA STREET · WESTMINSTER, S.W.1.

TUBES AND FITTINGS

Telephone: 32 WEDNESBURY. TRADE MARK Telephone: BRUNSWICK, WEDNESBURY.

On ADMIRALTY and WAR OFFICE LISTS.

BRUNSWICK TUBE WORKS,

EDWARD SMITH, LTD.

WROT IRON TUBES *for* GAS, STEAM, AIR *and* WATER.

WEDNESBURY.

BOILER, WELL & HYDRAULIC TUBES.

LAP-WELDED IRON *and* STEEL TUBES *for* ALL PURPOSES.

Grain Chill and Steel ROLLS, HEAVY CASTINGS.

IRON up to 100 Tons. *Special Air Furnace.*

STEEL up to 40 Tons. *Siemens' Steel Only.*

R.B.TENNENT, Limited, COATBRIDGE, N.B.

BALDWINS LTD.

G.P.O. Box No. 286 Baldwin House, 67, 69 & 71, Queen Victoria Street, London, E.C.4.

Galvanized and Self-Colour Rivetted and Welded

TANKS & CISTERNS

FOR OIL AND WATER STORAGE.

CORRUGATED & PLAIN SHEETS

KEGS, DRUMS & CANS

GALVANIZED PETROL STORAGE SAFES

SUPERIOR SILICA BRICKS

FINE SILICA CEMENT.

TRADE MARK—R. DINAS.

SMARTS DINAS SILICA BRICK CO. LTD., KIDWELLY

SPRUCE STREET

STRAW GOODS FACTORY

HULL.

(PROPRIETORS: WILLIAM OLSEN, LTD.)

ALL SIZES. ALL KINDS.

ALUMINIUM FILLING

IN POWDER FORM FULFILS THE SAME PURPOSE FOR ALUMINIUM CASTINGS AS "SCOLS" IRON & STEEL CEMENTS HAVE DONE FOR THE PAST 30 YEARS.

MAJOR, ROBINSON & CO. LTD.

Telephone: TRAFFORD PARK, 1760.

Telegrams: BLOWPIPE, MANCHSTR.

M SCOLS R TRADE MARK

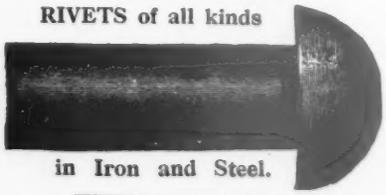
SCOLS WORKS, 385, CITY ROAD, CORNBROOK, MANCHESTER, 15.

THOS. GADD,

ROSS BOLT, NUT, and RIVET WORKS,

ROWLEY REGIS, near BIRMINGHAM.

RIVETS of all kinds



in Iron and Steel.

Telegrams: "Thos. Gadd, Rowley Regis."

Telephone: Blackheath 1020.

Established 1830.

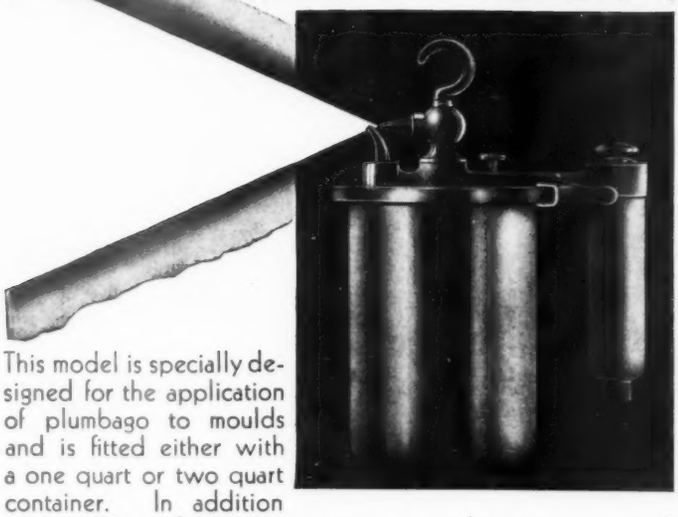
BRITISH MADE IRON & STEEL CEMENTS

SPECIALITIES:—

GRAPHITE & ASBESTOS PIPE JOINTING COMPOUNDS. ELASTIC CEMENT. OXY-ACETYLENE WELDING. PATENT TUBE BENDING MACHINES.

SUITABLE FOR IRONFOUNDERS, SHIPYARDS, BOILERMAKERS, GASWORKS.

TYPE D·A FOUNDRY GUN



This model is specially designed for the application of plumbago to moulds and is fitted either with a one quart or two quart container. In addition to the Type D.A. there is a comprehensive range of Aerograph De Vilbiss Spray Guns, covering the whole field of spray painting and finishing. These are described and illustrated in the new Aerograph Catalogue C.L.2, which we shall be pleased to send you free of charge.

AEROGRAPH·DeVilbiss

AEROGRAPH CO. LTD., Lower Sydenham, S.E.26. City Offices: 43 Holborn Viaduct, E.C.1

CVS—71

SPECIAL "G" QUALITY CUPOLA BRICKS

Works: HOMER HILL, BRETTELL LANE, TINTAM ABBEY, CROWN, DELPH.

Mines: RAVENSITCH, HOMER HILL, CROWN, DELPH.

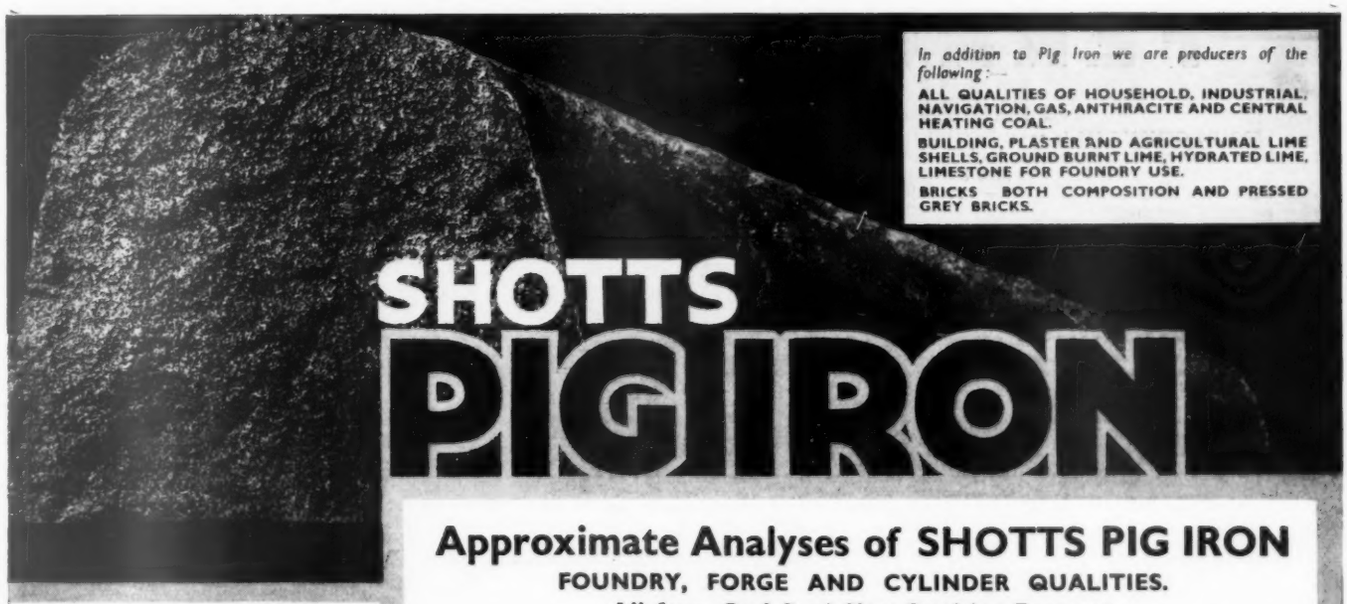
E. J. & J. PEARSON LTD.,
STOURBRIDGE
ESTABLISHED 1860

Telephone: 200 Brierley Hill.

Telegrams: "Firebrick, Stourbridge."

Blast Furnace Linings and Stove Bricks

Special "F.R.D." Coke Oven Bricks (High Silica Quality)



In addition to Pig Iron we are producers of the following:—

ALL QUALITIES OF HOUSEHOLD, INDUSTRIAL, NAVIGATION, GAS, ANTHRACITE AND CENTRAL HEATING COAL.

BUILDING, PLASTER AND AGRICULTURAL LIME SHELLS, GROUND BURNT LIME, HYDRATED LIME, LIMESTONE FOR FOUNDRY USE.

BRICKS BOTH COMPOSITION AND PRESSED GREY BRICKS.

SHOTTS PIG IRON

Approximate Analyses of SHOTTS PIG IRON

FOUNDRY, FORGE AND CYLINDER QUALITIES.

All from Coal fired Slow Smelting Furnaces.

	No. 1 %	No. 3 Soft %	No. 3 Medium %	No. 3 Hard %	No. 4 Soft %	No. 4 Hard %	Cyl. Iron %	Motor Cyl. %	No. 3 Low Phos. %	No. 4 Low Phos. %
Silicon ...	3.25	2.75	2.30	2.10	1.70	1.35	1.50	2.20	2.75	1.50
Sulphur ...	.02	.03	.04	.05	.06	.08	.09	.07	.04	.08
Phos.	.50	.50	.50	.50	.50	.40	.40	.32	.20	.20
Mang.	1.20	1.15	1.10	1.00	.95	.85	.85	1.08	.80	.80
Graphitic Carbon	3.55	3.40	3.30	3.15	3.10	2.85	2.65	2.80	3.30	2.85
Combined Carbon	.25	.30	.37	.45	.45	.63	.67	.60	.45	.65

Compositions other than the above regularly made to Customer's requirements.

The
SHOTTS IRON Co. Ld.
1 CASTLE ST., EDINBURGH.
Telephone:- 25232 EDINBURGH.
Telegrams:- "SHOTTS" EDINBURGH.

BRANCH OFFICE—
141 WEST GEORGE STREET, GLASGOW.
Telephone:- GLASGOW CENTRAL 1455
Telegrams:- "SHOTTS IRON" GLASGOW

XUM

HAVE YOU SEEN SOMMERFIELD'S NEW CATALOGUE?

IF NOT, WRITE FOR YOUR COPY TO-DAY!

CONTENTS:
PIG IRON, SANDS & FUELS, REFRACTORIES & MELTING APPLIANCES, GENERAL FOUNDRY REQUISITES, SAND BLAST PLANTS, MATERIALS & EQUIPMENT, PATTERN SHOP SUPPLIES, PROTECTIVE CLOTHING, PNEUMATIC TOOLS, BELTING, ETC.

REMEMBER WE CAN SUPPLY DIRECT FROM OUR LONDON STORES.

H. G. SOMMERFIELD, LTD., CHARTERHOUSE CHAMBERS, CHARTERHOUSE SQUARE, LONDON, E.C.1. Phone: CLERKENWELL 2869.

REPRESENTING ST. GEORGE'S ENGINEERS, LTD., MANCHESTER, SAND-BLAST PLANTS.

COLVILLES PIG IRON

BRANDS
DALZELL, GLENGARNOCK
CLYDE & MONKLAND

HIGH GRADE HEMATITE PIG IRON

SPECIAL & ORDINARY FOUNDRY QUALITIES & FORGE

SPECIAL REFINED WITH TOTAL CARBON GUARANTEED NOT EXCEEDING 3% MAX.

HEAD OFFICE:-
195, W. GEORGE ST., GLASGOW
'PHONE: CENTRAL 9280 'GRAMS: "COLVILLETT" GLASGOW

Write for our Illustrated Booklet

DON'T SCRAP CASTINGS
FERRUM CEMENTS...

FERRUM CEMENT M6 is specially made for Foundry use. It sets very quickly, is metallic, and when set becomes part of the casting itself. It can be filed like iron.
FERRUM CEMENT No. 2 is slower setting, but extremely hard and metallic.
The QUALITY of FERRUM CEMENTS is proved by the ever increasing sales during the past 20 years.

Literature and free sample tins from the sole manufacturers:

THE AMALGAMS Co. Ltd.
186, Attercliffe Rd, SHEFFIELD

Butterworth Bros. Ltd.

Founded 1795.

We are makers of "Anything in Glass."

Buy Butterworth Lighting Ware for satisfaction.

Newton Heath Glass Works, MANCHESTER, 10.

GROUND GANISTER.
STEEL MOULDERS' COMPOSITION.
SILICA BRICKS.
REFRACTORY GOODS.

WRITE FOR QUOTATIONS TO:-

PICKFORD, HOLLAND & CO. LTD. SHEFFIELD.

Telephone: 41922 ATTERCLIFFE.

Telegrams: "GANISTER, SHEFFIELD."

Sheepbridge Pig Iron

for **Forge** and **Foundry** purposes

Approximate Analyses.

	NEWBOLD			FOUNDRY					FORGE
	No. 3	Fdry. 4	Close 4	Silky	No. 1	No. 2	No. 3	No. 4	No. 4
Carbon (graphitic)	3·20	3·00	2·80	3·70	3·70	3·50	3·25	3·10	2.80
„ (combined)	0·30	0·40	0·50	0·04	0·08	0·12	0·24	0·30	0·50
Silicon	2·25 to 2·50	2·00 to 2·25	1·75 to 2·00	4·0 to 5·0	3·2 to 3·8	3·2 to 3·8	3·0 to 3·5	2·8 to 3·2	2·0 to 2·5
Sulphur	0·03	0·04	0·06	0·01	0·01	0·02	0·03	0·04	0·06 to 0·08
Phosphorus ..	0·75	0·75	0·75	1·4 to 1·5	1·4 to 1·5	1·4 to 1·5	1·4 to 1·5	1·4 to 1·5	1·4 to 1·5
Manganese ..	1·3 to 1·5	1·2 to 1·4	1·0 to 1·25	0·8 to 1·2	0·8 to 1·2	0·8 to 1·2	0·8 to 1·2	0·8 to 1·2	0·8 to 1·2

The above analyses are our usual ranges, but customers' requirements outside these can usually be met.

General Castings of 30 tons weight and upwards.

THE SHEEPBRIDGE COAL & IRON Co., Ltd.

Telephone: 2271. CHESTERFIELD Telegrams: Sheepbridge, Chesterfield.

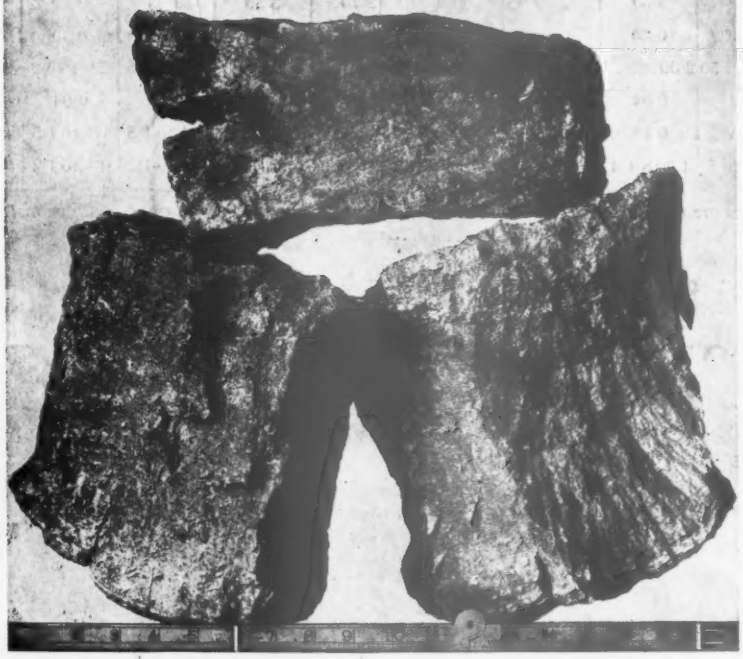
OIL FIRED ROTARY FURNACES
for
IRON
STEEL
BRASS
BRONZE
LEAD
SPECIAL ALLOYS Etc.

OVER
40
at work or under construction

STEIN & ATKINSON, LTD., 47, VICTORIA STREET, LONDON, S.W.1.

From the famous Langley Park Ovens

CONSETT FOUNDRY COKE



HOMOGENEOUS STRUCTURE

LOW ASH LOW SULPHUR

HIGH MELTING EFFICIENCY

LOW PHOSPHORUS LOW ARSENIC

HIGH SHATTER INDEX HIGH CALORIFIC VALUE

Improved Analysis gives better and hotter Coke

THIS FOUNDRY COKE is made from coal won from the best coking seams in Great Britain, cleaned, blended and scientifically carbonized in our own coking plant at Langley Park, County Durham. It is extremely hard, with great structural strength. Its high carbon percentage and low sulphur, ash, and moisture content mean economy in the cupola, with greater calorific value, which tends to give higher melting efficiency. The fierce, consistent heat of this Foundry Coke, with total absence of clinker, gives hotter, freer-flowing metal, which runs readily into the most intricate moulds, and results in clean, flawless castings.

Average Analysis

Taken over long period.

Fixed Carbon	91·52
Ash	6.66
Sulphur	·67
Moisture	1·74
Calorific Value B.T.U.'s per lb. of Coke	13,800
Shatter Test	94% on 2"
Fusing point of Ash	1540°C.

Everything that good Foundry Coke should be.

PIG IRON

CONSETT IRON CO., LTD., CONSETT, CO. DURHAM, ENGLAND

High-Grade Hematite and Foundry qualities supplied to customers' requirements. Let us quote you.

Descriptive Booklets free on request.

Telegrams: "Steel, Phone, Consett." 'Phone: Consett 104 (10 lines).

Published by the Proprietors, INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2; and Printed in Great Britain by HARRISON & SONS, LTD., 44/47, St. Martin's Lane, London, W.C.2.